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Research—A War Effort

FIFTY-FIFTH ANNUAL REPORT

OF THE

AGRICULTURAL EXPERIMENT STATION

UNIVERSITY OF MARYLAND
COLLEGE PARK, MARYLAND

1941-1942

To the Governor of Maryland, the Board of Regents,
and the President of the University of Maryland:

I transmit herewith the Fifty-fifth Annual Report of the University of Maryland Agricultural Experiment Station, as established by Act of Congress, March 2, 1887, containing an account of research and experiments conducted during the fiscal year ending June 30, 1942, and a statement of the receipts and disbursements for the same period.

R. B. CORBETT,
Director.

UNIVERSITY OF MARYLAND
AGRICULTURAL EXPERIMENT STATION

Volume 55 1941-1942

Research A War Effort

Being

The Fifty-Fifth Annual Report

For the Fiscal Year ending June 30, 1942

By R. B. CORBETT, *Director*

RECENT CHANGES IN EXPERIMENT STATION WORK

THE Maryland Agricultural Experiment Station has been a leader in adjusting its work to the war effort. About ten months before Pearl Harbor, at the suggestion of the Maryland Station, a committee of Northeastern Experiment Station directors was formed to consider adjustments to the then "defense effort." About a month before Pearl Harbor, the Maryland Station reported to a national meeting of Agricultural Experiment Station directors on adjustments that had been made to the war situation. The wisdom of this early planning and action has been proven by subsequent events.

One of the more vivid adjustments to the war effort has been the development of dehydration. The problem is clear when one considers the job of feeding an army of several million men scattered over the world under such varying conditions as are found in Northern Africa, Iceland, Alaska, and the Southern Pacific. In addition, this country must assist in feeding the Allied armies, the populations of occupied countries, and the partial feeding of the civilian populations in several of the Allied countries. The difficulties of this problem are intensified by lack of shipping space. The problem is further complicated by the shortage of materials for the usual food containers.

One of the best answers to this problem appears to be dehydration. Dehydration will apparently allow many foods to be kept under varying conditions over considerable periods of time. Dehydration so reduces the bulk and weight of food that it materially aids trans-oceanic shipment and the problems of army supply trains. The Maryland Station has developed experimental dehydrators and has produced dehydrated products under controlled conditions. The effects of varying humidity, temperature, air velocity, etc., have been obtained, thus giving basic information for further development and improvement of the dehydration of fruits and vegetables. This work has been carried on under the leadership of the Department of Horticulture with cooperation from Agricultural Engineering, Bacteriology, and the Bureau of Home Economics of the United States Department of Agriculture.

There are many things yet to be learned about dehydrated food. It may be in some instances that after a product is dehydrated, little more in food value than sawdust is shipped to our fighting men. It is important to know what happens to the vitamin content. The Maryland Agricultural Experiment Station is attempting not only to learn how to dehydrate, but also what happens to the nutritive value of the product during the process.

Certain of our fruit and vegetable crops are seriously damaged year after year by the outbreak of disease or the presence of insects. With the ever-increasing demand for food, the necessity for control of such outbreaks is of the utmost importance In spite of this need, the availability of some chemicals which have been used commonly in recent years in spray materials has been reduced and in a few instances almost eliminated. The Station is working with new combinations of chemicals to find effective substitutes for these shortages. Hand in hand with the shortage of chemicals goes the shortage of labor. The Station is working on concentrated sprays which will reduce the numbe of man-hours required to spray a given acreage of crops.

The shortage of dairy products has affected poultry and cal feeds. Many of these feeds have carried a considerable percentage of milk products. The need for milk for human consumption has placed a definite squeeze on the supply of dair products for animal feeds. The importance of milk for huma consumption is evident. In cooperation with making supplie available for human beings, the Station is developing feeds whc eliminate entirely, or virtually eliminate, dairy products.

A few of the other important lines of work can be indicate with a sentence: Maintaining crop production with shortage of certain fertilizer materials; keeping track of the labor suppl on Maryland farms and ways and means of increasing the eff ciency of farm labor; increasing the efficiency in distributio and marketing of farm products; more efficient feeding of dairy cows, beef animals, sheep and poultry under Maryland conditions; better storage of Maryland products once they have been produced; reduction of houseburn in the tobacco crop, and improved methods and facilities for storing sweet potatoes and Eastern grains. Some of this work involves freezing as a method of preservation.

It seems entirely probable that within a year the dominant internal problem of the nation will be the maintenance of an adequate food supply. Certainly, if there should be a poor crop year as compared with the series of excellent crop years that this country has enjoyed, the attention of the entire nation will be focused on the production of adequate food.

The Maryland Agricultural Experiment Station is contributing to the nation's all-out attempt to feed itself, its armies, and its allies.

ECONOMICS ON THE FARM

FARM ORGANIZATION AND MANAGEMENT

Dairy Farm Organization—Dairy farmers have been asked to produce more milk. The ability of dairymen to meet the increased milk production goals, and at the same time keep the industry on a sound basis, depends upon the application of efficient farm management practices to the business.

Records for the last three years have been obtained on 54 dairy farms. They show some significant differences. Labor income on all these farms in 1940 averaged $1,493; on the most profitable farms, it was $2,863; and on the least profitable farms, $409. The most profitable farms had, on the average, 26 cows compared with 15 cows on the least profitable farms; they had 2.4 acres of pasture compared with 1.9 acres; they purchased considerably less dairy feed; and they spent one-third less for labor per $100 of receipts.

Census of Agriculture—The data obtained periodically by the census are always extremely valuable for determining various trends in agriculture. It is doubtful if any previous census period of equal length has shown such marked shifts in the State's agricultural pattern as was shown in the 1930-1940 period. These changes were caused by the economic depression, "back to the land" movement, agricultural adjustment programs, competition from other areas, Government purchases of land, and new or improved varieties.

The pertinent agricultural data in the 1940 Census of Agriculture for Maryland were analyzed and presented to show the relative importance of each county in the production of each commodity.

Raising Dairy Heifers—With the need for increased milk production, farmers in certain areas may need to purchase additional cows to meet the production goals, and to either raise or purchase heifers for replacement.

For their guidance, a study was undertaken to determine the number of replacements needed, the feed required for raising heifers to maturity, and whether it is more economical to raise dairy heifers than to purchase them.

It was found that the cost of raising a dairy heifer varied from $74.45 in 1932 to $99.76 in 1941. The outlay for purchase of feed accounted for $54.67 of the total cost, and labor, pasture, silage and barn space accounted for $33.08. The average age of heifers at freshening was about 27 months. There was one dairy replacement annually for each 5.5 cows.

Farm Labor Requirements—Some farmers produce crops with half the labor used by other farmers, and without sacrificing yields. Records were obtained on the major crops grown in the various type-of-farming areas to show the amount of labor used in producing the several crops, and why labor requirements vary widely for the same crop in different areas and for different crops in the same area. The 11 crops studied were: corn for grain, corn for silage, sweet corn, wheat, oats, barley, rye, alfalfa hay, soybeans, and Irish potatoes.

This study indcates that methods and practices followed by farmers using less labor per crop acre, practices that farmers might use with still less labor, and the types of machinery are of greatest importance in saving time.

Organization of Truck Crop Farms—A study of the crop pattern on truck crop farms in four areas of the Eastern Shore of Maryland indicated some definite suggestions as to organization and farm management practices which would increase farm incomes and better conserve land resources.

Approximately 127 farms were surveyed in six areas of Wicomico, Somerset, Dorchester, Worcester, and Caroline counties. Suggested farm budgets were prepared for three farms in each of the major land use areas. These budgets show in detail the organization and farm management practices carried on at the time the study was made, and suggested changes and improvements.

The results indicate that farmers could profitably increase their incomes by adjusting the acreages of specific crops so as to provide an economical unit for the use of certain types of machinery and equipment. It is suggested also that they make more use of cover crops, soil-building crops, and other soil improvement practices. Much of the land is imperfectly drained.

Insufficient livestock is kept in these areas to provide for needs of the families and some increase in livestock production is suggested. Greater care in grading and standardization of their products by farmers is needed.

FARM TAXATION AND FINANCE

Farm Property Assessments—Information was assembled and analyzed regarding the assessment of property in most counties in Maryland. This information serves as a background and guide for future assessing of farm property and should stimulate an improvement in methods and procedure.

Widespread inequalities in farm real estate assessments existed at the time this study was made. Variations existed in the assessment of livestock and such property escaped assessment to some extent. Arbitrary rates for a given class of farm land bordering a given type of road were prevalent in many counties. Net changes in assessed values by reassessing were relatively small. Building assessments were changed more frequently and the changes were greater than in land assessments, especially the low value unit farms which were relatively over-assessed. Several tests showed that the reassessing resulted in improvement in the assessment of both real estate and livestock, but that such improvement was not great.

The "full cash value" sales basis for assessing farm property may be too complex under present assessing procedure. More uniform policies should be adopted in assessing farm real and personal property units. Assessors should be given more instruction and supervision in classifying farm property. Material aids, such as tax maps, soil maps, and sales data, should be utilized to a greater extent by local assessors.

Improving or Surfacing Rural County Roads—A clear picture of the extent to which highway-user tax contributions, due to traffic over county roads, support such roads was obtained from traffic counts at 20 rural road intersections in 10 election districts of 7 counties during 1941. The amount of supplementary taxes necessary to finance county road programs can be calculated. A more equitable allocation of state gasoline taxes to counties can be based on factual data pertaining to use of highway and highway tax contributions. Such data assist also in determining the limits of capital expenditure per mile for various county roads.

In this study, the taxable basis of property bordering the roads on which traffic counts were made was determined. A tabulation was made of the population, number of livestock, and other data for farms bordering the roads. Motor vehicle characteristics of about 1,000 farmers and 2,700 non-farmers in 18 counties were taken from original road use interviews of the Maryland State Planning Survey. Motor vehicle tax contributions of farmers and non-farmers traveling on the county road systems were obtained.

The data show that many rural local roads carried small volumes of traffic. Taxable resources along such roads were too meager to support extensive and costly road improvements. Average annual automobile travel by farmers was about two-thirds that of non-farmers. Farm trucks were driven less than half the mileage of non-farm trucks. The average mileage driven by farmers varied more widely among counties than the mileage driven by non-farmers. Traffic over the county road systems of 18 counties produced considerably less highway-user taxes than the amount spent on the county systems from the gasoline tax.

Annual Report of Farm Bureau-Grange Joint Tax Committee—The average combined state and county tax rates applied to farm property in Maryland reached a peak in 1929-30 at $1.83 per $100 of assessed value. By 1934-35 these rates had decreased to $1.21, and the combined rates for 1941-42 had increased to $1.50.

The report reviews the urgent need for additional revenue, especially for Federal purposes, and indicates that farmers can expect to pay increasing amounts of hidden taxes in the immediate future. It deals with the surplus revenue problem and recommends specifically the following alternative uses of such surpluses if they continue to increase in the future:

1. Increase the state contribution to the school equalization fund so that the county tax rate requirements for participation in the school equalization fund can be reduced to the former 47 cents.
2. Amend the 1941 act which authorizes the issuance of state bonds at certain dates, to the effect that those series authorized but not yet issued, will not be issued. Anticipated improvements, based on the sale of these series not yet issued, may be paid for directly from the surplus fund.
3. Improve main highways or match Federal funds for that purpose.
4. Reduce the state property tax.

INSURANCE AND CREDIT PROBLEMS

Farmers' Mutual Fire Insurance—The annual loss from rural fires in Maryland is at least $1,500,000. Protection against fire is more important to rural dwellers than to city inhabitants because of the lack of fire departments in rural areas. Fire insurance is the most universal kind of insurance among farmers.

In 1939, farmers' mutual fire insurance companies in Maryland held net insurance in force approximating $272,000,000, of which 90 per cent was held by the 12 advanced premium companies and 10 per cent by the 4 assessment companies. The 1939 membership was 116,138, about one-half of which was made up by farmers. Policies in force numbered 129,837, or 1.1 policies to every member. Income averaged 50.9 cents per $100 of insurance in force, and net premiums paid out accounted for 84 per cent of the total income.

The following essentials for successful operation of mutuals were indicated by a study made of them:

1. Periodic inspection of risks and adjustments of values during periods of declining or rising prices.
2. Build up adequate reserves during years of light losses.
3. Competent personnel to make inspections.
4. Proper reinsurance arrangements of the companies to more adequately serve their clientele.
5. Sufficient volume of business for economical operation.
6. Efficient operation to maintain low loss and expense ratios.

Short-Term Farm Credit on the Lower Eastern Shore—The Eastern Shore of Maryland is a specialized cash crop area confronted with credit problems inherent in the cropping systems. If the use of credit is excessive, the cost of production may be increased unnecessarily.

A survey showed that in 1939 approximately $148,000 in short-term credit was borrowed by 210 farmers. Cash loans accounted for about 20 per cent; merchant credit, 70 per cent; installment credit, 6 per cent; and open accounts, 4 per cent. Farmers used merchants as a major source of operating capital in the form of commodity purchases, probably because merchant credit could be obtained quickly, easily, and without the use of collateral. Local banks were the principal source of short-term cash loans, accounting for over 50 per cent of all cash loans.

Purchase of feed accounted for 59.4 per cent of merchant credit; fertilizer, 22.9 per cent; livestock, 14.2 per cent, and the remainder was used for purchase of machinery, plants and seeds.

Since increased production of poultry products and certain vegetables is called for in the food production program, it is important that credit to the producers of these commodities be made available in the amount necessary and at the lowest possible cost. This study not only deals with the various kinds of loans, but also points out the agencies which are established and designed to loan money to farmers at reasonable rates of interest. Farmers can materially reduce their interest payments through wise planning and budgeting of farm operations and prudent judgment in the use of credit.

Farm Mortgage Debt—Farm mortgage loans outstanding in Maryland declined from $50,830,000 in 1932 to $42,415,000 in 1941. The average interest rate was 5.9 per cent in 1932 and 5.1 per cent in 1941.

Upon the handling of such indebtedness depends the future welfare of many farm families. For that reason, a study of past experiences was conducted which shows the effect of cyclical movements, the influence of prosperity from wartime economy, and the consequences of economical and financial collapse, commonly referred to as a depression. It is hoped that such information may assist in averting the recurrence of mistakes made by farmers in former situations.

Generally, farmers should proceed cautiously and deliberately, and, above all, avoid speculation in land. More specifically, the following suggestions are made:

1. Expand plant and equipment only to the extent consistent with the national food production program and economical farm management practices.
2. Pay debts as rapidly as possible. Increased incomes should be used to reduce present debt to the extent that it will not be burdensome should income be reduced materially in due time.
3. Accumulate adequate savings for contingencies.
4. Invest surplus income in war bonds.
5. Make every effort possible to prevent a speculative rise in land values.
6. In purchasing a farm, evaluate it on the basis of the normal agricultural value; that is, the normal production of crops and livestock valued at average prices over a long period of years.
7. Encourage partnership arrangements between son and father, provided the size of the farm justifies it, in order to assist more young farmers to become farm owners.

MARKETING FARM PRODUCTS

Marketing Maryland Broilers—The broiler industry on the Eastern Shore has developed rapidly in recent years, accompanied by many changes in production practices, marketing methods, and methods of financing. It has increased from 2,000,000 birds in 1934 to 14,000,000 broilers in 1941. Average annual production per farm had increased to 35,546 birds in 1941.

In the summer of 1941, a survey was made of 330 broiler producers, 23 operators of hatcheries supplying broiler chicks, and 8 operators of poultry dressing plants.

A large percentage of Maryland broiler chicks purchased came from local hatcheries. About 78 per cent of the eggs for broiler chicks were purchased in the northeastern states. About 94 per cent of all broilers raised in Maryland in 1940 were crossbreds.

Various types of contract production arrangements have been developed recently. Marketing methods have been influenced profoundly by the introduction of dressing plants in the area. In 1942, Maryland broilers marketed dressed through these plants may constitute as much as 85 to 90 per cent of the total.

Wartime Prices and Agriculture—During every major war, wholesale prices, farm prices, and retail prices have risen as a result of increased industrial activity, increased purchasing power, and greater demand for the products of agriculture. It is equally true that following wars prices have always declined, completely wiping out any temporary gains during the so-called periods of prosperity.

Planning, regulation and control are necessary to prevent inflation. Price trends and relationships from the period before World War I to date are being analyzed to determine the effect of price inflation on agriculture and to point out specific things which need to be done to prevent a similar recurrence of the disastrous effects that followed the last world war.

Transportation in Marketing Farm Products—About 4,000 origin and destination survey questionnaires of the Maryland Highway Planning Survey are being tabulated to determine the type of truck, type of body, and capacity of truck; place of origin, type of origin and destination of trucks; commodity being transported; and the empty and loaded weights of trucks. Information of this kind has been taken for important highways leading into Baltimore and Salisbury.

The data indicate that a considerable proportion of trucks move as empties, especially one way, and that hauling farm supplies is an important part of the truck business. The study will supply basic information on the volume, routes, travel, and character of farm products and supplies moved by motor trucks in Maryland. Such data will serve as a basis for determining priority use as well as most effective use of motor trucks for civilian and war needs.

FARM MACHINERY AND EQUIPMENT

Dehydration of Fruits and Vegetables—How to preserve fruits and vegetables in a form that they can be sent to all parts of the world, and that will not require the large amounts of critical materials ordinarily used in canning, has become one of the most important issues of the present times.

A study of problems involved in dehydration of fruits and vegetables is well under way. A small electric drier has been completed. It is used to work out details of the dehydration process where only small quantities of materials are available. Preliminary tests indicate that the drier may prove of considerable value for home use.

A larger model of a tunnel drier was constructed to act as a check on the work of the smaller unit. Special emphasis is being placed on the commercial aspects of dehydration to help canners who face a shortage of cans and thus provide a market for the vegetables which they would can normally. This will help also in providing the needs of the armed forces and for lend-lease.

Grain Storage on the Farm—It is difficult for farmers to dry their grain at harvest time sufficiently for safe storage on the farm. In recent years, the need for storing it on the farm has been greater than normal.

Following favorable results with a type of grain drier developed at the University of Maryland, assistance was given in construction of a large grain drier at Chestertown for custom drying. It is expected to give much valuable information as to the problems connected with operation of such a unit on a custom basis.

Due to the shortage of steel, a large number of the parts were built of plywood, so as to reduce the amount of metal used to a minimum. This unit has approximately four times the capacity of the portable unit tested previously. Preliminary work indicates that similar results are obtained, but that for Maryland conditions the unit is too large for practical custom work.

Sweet Potato Curing and Storing—Losses during curing and storage of sweet potatoes have been among the most troublesome problems of growers of that important crop. Preliminary studies in farm sweet potato houses indicate that present facilities do not permit sufficient control of temperature and humidity to provide proper curing conditions. In one typical sweet potato house, the temperature spread between floor and ceiling was as great as 25 degrees during cool weather, with considerable variation in temperature at any one point during the curing period. Humidity varied over an even wider range. Only rarely did humidities approach the conditions which have proved ideal in research on small lots of potatoes.

Construction of two sweet potato houses for experimental study of heating and ventilating equipment and other storage factors is under way. In the two similar houses it will be possible to make direct comparisons of various types of heating equipment and forms of ventilation.

Egg Coolers and Cooling Conditions—Work on maintenance of egg quality on the farm is being continued. A commercial cooling unit has been adapted to an egg cooling and storage box in which desirable temperatures and humidities can be maintained easily. Actual data on egg quality must still be obtained.

Tobacco Curing—Preliminary work has been started to measure the air conditions in various tobacco barns during the curing period. It is the aim to determine possible changes in management or barn design which will improve tobacco quality.

FARM CROPS, SOILS, AND SEED INSPECTION

Sweet Corn Production and Breeding—Work is carried on continuously to aid canners and growers in getting improved sweet corn seed for their various requirements. As a result of tests conducted by the Experiment Station, losses from using unadapted sorts are largely avoided. Up-to-date performance records are made available for new hybrids by the time they appear on the market. In addition to field test work, foundation breeding stock is being developed for Maryland.

In 1941, 83 hybrids and 4 open-pollinated varieties were included in replicated tests. In the nursery, 147 local inbred lines were studied to obtain white and yellow lines prepotent for both productivity and quality. One of these lines, H84, continued to demonstrate its ability to transmit high productivity to its progeny. The best yields in the 1941 tests were made by experimental hybrids using Maryland Inbred H84 as one parent. This inbred has now been distributed to a number of sweet corn seed producers in the Northeast.

Development of Dent Corn Hybrids—In 1941, at least one-fourth of the acreage of corn in Maryland was planted to hybrids, and most of the hybrids used were chosen on the basis of records in tests conducted in previous years by the Experiment Station. These tests provide answers to many local problems arising from the acceptance by farmers of a crop with which they have had little experience.

During the year, 78 hybrids and 6 open-pollinated varieties were compared in replicated tests at one or more of five locations. One hundred and sixty-three Maryland inbred lines were carried into the F_4, F_5, and F_6 generations. Many experimental hybrids involving the most promising local lines were made.

In 1941, as in the three preceding years, the yield of the top-ranking open-pollinated variety was exceeded by that of hybrids. For the 5 test locations, yield differences in favor of the leading hybrid variety ranged from 10.7 to 21.2 bushels per acre. U. S. 13 and hybrids related or similar in type were outstanding.

Wheat—Hybridization and Selection—The search for new and better varieties of wheat has continued. Twenty-one varieties were compared on triplicated drill plots. Selections were made from hybrid plants in the nursery for the purpose of finding strains that are superior to those now available.

Barley—Hybridization for Smooth Awns—The rapid increase in acreage sown to barley in Maryland in recent years, and the place which barley has assumed in feeding operations have greatly increased the desirability of obtaining the best adapted varieties possible.

Eight varieties were compared and new smooth awn selections were isolated in the nursery. In cooperation with the U. S. Department of Agriculture, 40 selections were included in a planting made for winter hardiness observations. Smut-free foundation seed of Marnobarb, a local smooth awned variety, was multiplied for distribution to seed growers.

Improvement, Production and Use of Rye in Maryland—Tests on 8 varieties of rye were made at 4 locations to determine what available varieties may be grown successfully in Maryland for distilling purposes.

Yield data appear to support the following observations: Poorest yields for all varieties occurred on sandy soils; Rosen, the variety commonly accepted as a desirable type for distilling, made its poorest comparative showing in the low-yielding test on sandy soil, although on good small grain soil in central Maryland this variety led all others in yield per acre; for all tests, the two high starch varieties, Rosen and Imperial, were within two bushels of the yield of Balbo, the most productive variety in the comparisons; average kernel weight was closely associated with yield per acre; under conditions of the 1940-41 test, high nitrogen fertilizer consistently gave the best yields per acre.

Hay, Forage and Pasture—The major portion of this work continued to be testing of strains of red clover and alfalfa.

Annual Legumes—Soybeans—Wartime conditions have brought soybeans to the front and information regarding their production in Maryland has added value.

Variety tests were conducted at College Park and at Ridgely. Best yields were made by Scioto and Manchu at College Park and Scioto and Illini topped the list at Ridgely.

Silage yields for soybeans drilled alone and drilled in combination with Sudan grass, Hegari sorghum, and with early-maturing hybrid corn were compared at College Park with yields obtained from a silage-type hybrid corn planted in cultivated rows in the ordinary manner. Yields per acre in tons of green material at 72 per cent moisture were: soybeans alone, 7.4; Sudan grass and soybeans, 10.8; Hegari and soybeans, 13.8; corn and soybeans, 13.7; corn in rows, 11.7.

Pasture Improvement—An ideal permanent pasture provides uniformly high production of palatable and nutritious forage throughout the growing season. Typically, pasture production is deficient after early July. An important feature of the pasture studies in progress is an evaluation of the practices in use on different farms to provide a balanced pasture program and the effects of these practices on milk production, animal weight, and feed economy.

In addition, records are obtained on the seasonal production of forage from the different important pasture species by use of pasture cages, both at the Station and on farms in the state. These records show that judicious use of lime, phosphorus and potassium typically at least double the production of permanent pastures, but accomplish little in extending production over the grazing season.

Encouraging progress continues in the breeding program to improve orchard grass and ryegrass.

Effects of Different Short Rotations—Thirty-nine crop rotations started in 1940 were under way in 1941. Although this work has not progressed far enough to establish trends in yields and soil fertility, some observations were made on results of seeding cover crops on dry seed beds. Vetch, crimson clover, and rye were more successful than ryegrass or cowpeas when sown at the last cultivation of corn. Soybeans inter-tilled on wheat and barley land in the spring failed to make a crop.

Soil Fertility Studies on the Hopkins Farm—On an area of acid soil, very low in organic matter and in poor physical condition, a series of plots has been established to determine the problems involved in building a productive soil. A standard three-year rotation is maintained, and different ranges are held at pH readings of 5.5, 6.5, and 7.5. Many fertilizer treatments are used on different plots.

On an adjacent area, where the soil is in better condition, various of the newer carriers of phosphorus are compared with older and standard carriers to observe their relative efficiencies.

Several more years will elapse before definite conclusions can be drawn from this work.

Factors Affecting Available Potassium in Maryland Soils—It has been indicated by other studies that potassium deficiency in Maryland soils shows a gradual increase.

Results of this study indicate that superphosphate applications decrease the amount of available potassium. Lime and superphosphate appear to increase calcium at the expense of potassium in the exchange complex of the soil.

These results are in accord with others which indicate that, on a long-time basis, the applications of potash to most Maryland soils could be increased with profit.

Efficiency of Soil Fertility Management—In a continuing study of 28 farms in 13 counties, trends in crop yields, fertilizer applications, and plant nutrients in the soil are recorded. Records to date point to the need for increased use of potassium, along with the phosphorus and nitrogen in commercial fertilizers.

There is evidence that increased use of magnesium in the liming materials is desirable, particularly on the Coastal Plain soils.

Conservation of Soil Moisture—Unterraced hillsides tend to accumulate subsoil moisture near the foot of the slope, while subsoil moisture is distributed with greater uniformity throughout slopes that are terraced. This was shown by moisture determinations to a depth of 14 inches at frequent intervals throughout the season under various crops on the University farm.

Methods for Increasing the Capacity of Soils to Hold Available Plant Foods—It has been found that many Maryland soils can hold only relatively small quantities of available plant food materials because of a deficiency of inorganic colloids. It has been determined that this deficiency can be overcome in part by building up a supply of organic colloids. An attempt is being made to learn the types of plants that are most efficient for such a purpose.

Progress was made during the year in devising means for distinguishing organic and inorganic colloids in soil samples.

Tobacco Investigations (In cooperation with the Bureau of Plant Industry, U. S. D. A.)—Studies of tobacco production have been in progress for many years at the Tobacco Substation at Upper Marlboro. The work now being carried on includes breeding, variety testing, fertilizer tests, and tests of cropping methods.

As a result of the breeding program and variety testing, certain disease-resistant strains have been distributed widely through Southern Maryland.

The most outstanding features in results of fertilizer tests are the continued beneficial effects of sulphate of potash on both yield and quality, and the clearly marked deficiency symptoms on plants from plots where different minerals are deficient. The exaggerated deficiency symptoms on these plots have made it possible to recognize symptoms in farmers' fields, where they are less clearly marked, and to advise intelligently on soil treatment.

In this period of labor shortage, the weed plots are of particular interest. Not only is the tobacco of the highest quality when it is produced on land that has been in weeds for a period of years, but the weeds which occupy the land are not those that are troublesome under cultivation. As a result, tobacco following weeds is so free from weed growth as to need a minimum of cultivation and no hoeing.

Seed Inspection—Agricultural seeds sold throughout the state were inspected for tagging and samples were collected for laboratory study. The completeness and accuracy of the tagging of these collected samples was slightly below that of last year, but above the five-year average.

The number of seed samples submitted to the laboratory during the year was the largest on record. This phase of the work has grown steadily over a long period. Approximately three-fourths of the 3,539 seed samples submitted were field crop seeds. Tobacco growers submitted 654 samples of tobacco seed for cleaning, treating, and germination. No other group of farmers makes so great use of the facilities of the laboratory.

It has been found during the last two years that seed disinfectants may cause more or less serious injury to seed grains. To avoid such injury, grain to be treated should be cleaned and dried to a suitable moisture content. When large batches of seed grain are treated, care should be exercised to see that the disinfectant is applied uniformly to the entire batch or the overtreated portion may be injured.

BEEF CATTLE, SHEEP, HOGS AND HORSES

Barley Compared With Corn, and Corn Silage with Legume Hay in Fattening Rations for Steer Calves—The second year of a cattle feeding experiment brought significant results for the feeders of the state.

Four lots of high-quality steer calves, 10 head in each lot, were fed each year for two years.

The check lot was given a ration of shelled corn, soybean oil meal, corn silage and legume hay. The second lot received the same total grain ration, with the roughage portion of the ration consisting solely of legume hay. A third lot was fed the same total grain ration as the check lot, but received only a limited amount of legume hay and all the corn silage that could be consumed readily. A fourth lot was given a ration differing from the check lot only in the feeding of crushed barley in place of shelled corn, and at a slightly higher level to compensate for the difference in content of total digestible nutrients in these grains. Nutritive ratios of the test rations were made similar to that of the check lot by adjusting the amount of soybean meal fed.

In the first year's experiment, U. S. No. 2 alfalfa hay was fed, and in the second year's experiment, U. S. No. 2 clover-light timothy hay. U. S. No. 2 shelled corn and U. S. No. 2 crushed barley were fed in each experiment.

The results showed that addition of a limited amount of corn silage to a ration of shelled corn, soybean oil meal and legume hay increased the rate of gain, lowered the cost of producing gain, increased the profit per steer, and produced a slightly higher finished steer.

Increasing the amount of silage fed to a point where it comprised the greater part of the roughage fed did not give satisfactory results in the first year's test. In the second year's test, with other feed costs relatively much higher and with a hay of lower quality being fed, the results were strongly in favor of heavy silage feeding.

Crushed barley proved to be a satisfactory substitute for shelled corn in each experiment. An average of the two years' results indicates that the value of crushed barley of No. 2 grade is approximately 89 per cent of shelled corn of No. 2 grade.

Swine Breeding Investigations—The Maryland Experiment Station is cooperating with the Bureau of Animal Industry, U. S. Department of Agriculture, in a swine breeding experiment that has been in progress for two years. Crosses of the Danish Landrace and Berkshire breeds are being made for the purpose of developing a strain of black hogs combining the most desirable characteristics of each parent breed.

Wintering Rations for Pregnant Ewes—Corn silage, supplemented with ground limestone, is being compared with U. S. No. 2 clover-light timothy mixed hay in the wintering rations for pregnant ewes. The first trial of this three-year experiment was concluded on May 1, 1942.

Three lots of 13 ewes each were used in the test. The daily feed per 100 pounds live weight was 1.75 pounds of corn silage and 1.75 pounds of U. S. No. 2 clover-light timothy mixed hay for Lot 1. The ration for Lot 2 was 2.63 pounds of U. S. No. 2 clover-light timothy mixed hay. And for Lot 3, it was 3.50 pounds of corn silage and .87 pound of U. S. No. 2 clover-light timothy mixed hay.

Shelled corn and linseed oil meal were fed to each lot. The amounts of digestible nutrients in the rations were made similar by adjusting the amounts of corn and linseed oil meal fed.

The most noticeable effect of the different rations was on the vigor, weight and condition of the ewes. Those in Lot 3 maintained their weights more satisfactorily during lactation and finished the lactation period with greater vigor and more condition than the ewes in Lots 1 or 2. At the close of the first trial the ewes in Lot 3 were still producing a heavy flow of milk; those in Lots 1 and 2 were all nearly dry.

The ewes in Lot 2 showed the greatest loss in weight during lactation, finished the trial in the poorest condition, and showed the lowest vigor.

Common recommendations are that pregnant ewes be fed not more than 2 pounds of corn silage per 100 pounds live weight. The first trial in this experiment seems to indicate that corn silage can be fed in amounts up to 3.5 pounds per 100 pounds live weight with satisfactory results. It is indicated by the results obtained thus far that pregnant ewes receiving corn silage will maintain their weight, vigor and condition more satisfactorily than those receiving no corn silage.

It is possible that there may be a carry-over effect of the respective rations in later gestation periods. To measure this the ewes will receive the same wintering rations each year. Ewe lambs will be placed back in the experiment in the same lot with their dams to measure the effect of the ration on the reproductive capacity of the offspring.

Arterial Injections as a Means of Curing Hams Rapidly—The usual method of curing hams by immersion in brine solution is open to criticism because of its failure to obtain immediate and uniform distribution of the salt throughout the meat and because of the time required to accomplish a satisfactory cure.

Fifty-four commercial hams were cured by various methods of brine treatment—arterial injection, "stitch" injection, and immersion in brine. In arterial injection, brine was forced into the arterial system either by a pressure pump or by gravity. Hams were "stitch" pumped by inserting the needle into the muscle tissue on the face side of the ham at three points.

The gravity system of injection developed a pressure of about 1.6 pounds; with the pressure pump, brine injections were made under 10, 20, 30, and 40 pounds pressure.

The pressure under which brine is injected appears to have little effect on the salt content of hams, or upon its distribution among the several muscles. Stitch pumping produced local brine pockets and resulted in a less uniform salt distribution than did arterial injection.

Salt analyses made at varying intervals show that injected hams contain much more salt than is necessary for their proper preservation. It is probable that the salt content of injected hams can be reduced either by regulating the concentration of the brine, or by limiting the amount of brine injected, or both.

Further study of this important problem is necessary before any definite procedures can be established.

DISEASES OF ANIMALS

Bang's Disease—During the last five years persistent efforts have been made to develop methods for immunizing calves against this disease. Extensive field trials were conducted in which strain 19 vaccine, produced and standardized by the Beltsville Research Center, were used in immunizing calves between the ages of four and eight months.

Records on more than 2,000 calves so vaccinated show that approximately 5 per cent retain a positive reaction for at least 12 months following vaccination and about 16 per cent show a suspicious reaction for at least that period. Such animals appear to breed normally and it has not been possible to isolate live Brucella organisms from them when they were in milk production. Tests do not differentiate, however, between animals having a positive reaction as a result of vaccination, or due to infection. Those showing a positive reaction for any cause cannot remain in an accredited herd when they have reached 24 months of age.

In view of these results, it appeared desirable to develop a better method of vaccination and apparently intradermal injection of approximately 1/10 c.c. of the standard vaccine accomplishes this end. This method was first employed by Dr. Melvin Rabstein of this laboratory and has been used under closely controlled conditions on some 40 calves. In each instance the animals become positive to the blood test within about 7 days and this subsides within two to four months, in contradistinction to methods used previously. Tests indicate that up to at least six months—the length of time this work has been in progress—there is no difference in the degree of immunity by the subcutaneous and intradermal methods of vaccination.

Intradermal vaccination has also been employed in certain herds of mature animals following an acute outbreak of Bang's disease accompanied by abortions. Early results indicate that a fairly high percentage of animals so vaccinated become negative to the blood test within 12 months, but that similar groups vaccinated by the subcutaneous method retain their positive reaction for a prolonged period.

These new procedures appear to offer a practical solution to many of the objections to the use of strain 19 vaccine, and also to offer a possible means of establishing immunity in mature animals without causing them to show a positive blood reaction for a prolonged period. Positive statements cannot be made at this time as to how long immunity induced by intradermal vaccination will persist. That can be determined only as animals so treated continue to show or not show resistance over a period of years.

Mastitis in Dairy Cattle—At present, probably 75 percent of our dairy herds have infectious mastitis of one or more types, and between 20 per cent and 30 per cent of the animals in these herds are infected in one or more quarters. Infected quarters, although giving apparently normal milk, produce from 25 per cent to 50 per cent less than from a correlated quarter. Udder injury and death losses are usually recognized as constituting the major losses. Little consideration has been given to the reduction of milk yields by mastitis, but it is probable that this also should be considered a major item of loss.

Evidence so far indicates that accurate diagnosis, suitable treatment and good sanitation, when employed continuously in a dairy herd, can eliminate mastitis in the majority of instances. Improvement is needed in all three factors and work toward that end is in progress.

Streptococci continue to be found as the predominant organism in about 70 per cent of the cases. Treatment with colloidal silver oxide and gramicidin appear to be superior to other means. Approximately 75 per cent to 80 per cent of the quarters so treated become negative to test for streptococci.

Staphylococci mastitis appears to be more destructive to udder tissue and, when found in acute form, may not only ruin the udder but death losses from toxemia are not uncommon. No drug or chemical has been found thus far which controls the infection in the udder or reduces losses. A staphylococcus toxoid developed at the Beltsville Research Center has been used in certain herds with favorable results. The treatment does not eliminate the staphylococcus organisms from the udder, but merely reduces udder damage and death losses.

Genital Trichomoniasis of Cattle—This infection is now present in several breeding herds in this country and it is important that efforts be directed to preventing it from becoming widespread as has occurred in some European countries.

Infection is spread primarily by the bull. Careful scrutiny of the breeding and health record prior to the purchase of a mature herd sire is therefore important. Diagnosis of the infection can be made by finding the protozoan microscopically and through the breeding record. Blood tests have not proved reliable so far and better methods of diagnosis are needed.

Progress has been made during the last year in developing methods and techniques for growing the protozoan in pure culture. It is possible that since cultural methods have been developed, improved methods of diagnosis may be devised and the susceptibility of the organism to chemical agents which may kill it in the animal may be studied.

Swine Brucellosis—This disease was studied during the past year under both field and laboratory conditions, with a view to determining the blood picture in infected and uninfected swine and the efficiency of the agglutination test as a means of diagnosis.

Evidence so far indicates that animals that react in a dilution of 1-25 positively should be considered infected, and the male animal is quite capable of spreading infection through breeding. At present, it appears that infection can be eliminated from a heard of breeding swine only by removal of all animals reacting in a dilution of 1-25, or higher. Eradication procedures are further complicated by the fact that certain animals apparently harbor and disseminate the infection, yet do not show any changes in the agglutination titre.

Infectious Encephalomyelitis of Horses and Mules—Very few cases of this disease were reported in the United States the past year, and none were proved in Maryland. The virus of this infection, however, is fairly widespread and has been found in several avian and mammalian species. Its recurrence in epidemic form at fairly long intervals is not well understood, but such epidemics can now be controlled. When an outbreak occurs, all equines in the area can be vaccinated and immunity established in sufficient time to prevent serious loss.

Blackhead Infection in Turkeys—Studies on this problem covering several years developed essentially the same findings as other investigators had found as to the cause, treatment and prevention of blackhead in turkeys. Phases of the problem which might have value were explored, but these investigations apparently did not warrant further study and the project was terminated.

EFFECT OF BACTERIA ON FARM PRODUCTS

Changes in Quality of Shelled Lima Beans—There is great need for definite information regarding the factors affecting the quality of various perishable vegetables, especially as pertain to the quality of the frozen product.

Results of work during the last year show that for preserving quality of lima beans, the holding period between shelling, blanching, packaging and freezing should be shortened as much as possible.

Lima beans are high in nutritional value, are also one of the most important truck gardening crops of Maryland, and, therefore, were chosen for study.

The experiment was carried out with three varieties of lima beans, using vined and sifted samples which contained limas at various ages of maturity. The beans were held in the vinery and after different holding periods tests were made on bacterial activity, souring, loss of vitamin C, and changes in appearance. Two varieties were held in big boxes under normal vinery conditions and a third variety was held under running water. Vitamin C and pH analyses were made on both green and white bean samples.

Of all varieties tested, the fresh green beans contained about twice the concentration of vitamin C as did the fresh white beans. Blanching for two minutes at 100 degrees C. was effective in a 94-99 per cent reduction in bacterial numbers, but resulted in a 34-38 per cent loss of vitamin C. Although there was little change in pH after 6 hours of holding, the two varieties held in boxes took on a brownish appearance and became sticky due to microbial surface growth. These changes were not observed in the variety held under running water. Loss in vitamin C was not apparent until after the 6-hour holding period for all varieties.

To determine whether the bacteria growing on the limas could destroy vitamin C, several pure cultures were isolated and studied in the laboratory. Some of the strains were found to destroy the vitamin very rapidly, while other strains actually protected it from rapid atmospheric oxidation. A mixed culture of microorganisms was found to destroy the vitamin.

Influence of Certain Microorganisms on Quality of Frozen Egg Products—The organisms *Escherichia coli* is used widely as an indicator of pollution in many foods. Its presence in frozen eggs has been assumed to indicate possible presence of human excreta, and, therefore, pathogenic organisms. However, *Escherichia coli* is present in the excreta of chickens, and it is necessary to differentiate between the human and chicken strains to judge correctly the significance of the presence of this organism in frozen eggs. Finding of the human strain would indicate unsanitary handling of the eggs.

Results of work conducted thus far indicate the possibility of developing a differential medium for distinguishing between the two strains of microorganisms.

PLANTS AND THEIR DISEASES

Sweet Potato Storage—Results on curing and storage of sweet potatoes have been given in previous reports. Additional experiments strongly confirmed the earlier observations that high relative humidity, combined with proper temperatures, is the decisive factor for effective curing.

The physiology of curing in sweet potatoes is imperfectly understood and opinions differ as to the essential changes in the roots during effective curing. Results of extensive studies at this Station on the metabolism and pectic transformations in the roots cured under different conditions are being assembled and organized for publication.

Fundamentals in Grain Storage—Bulk storage and transportation of cereals is an important national problem at the present time. The engineering phases of this problem must be based upon scientific knowledge of the vital activities in the living kernels, and especially of the conditions that alter the energy-producing processes in the kernels.

Investigators at this Station have been able to measure some of the factors involved in grain storage and obtain some of the basic information needed. Experimental work was halted by the scientist in charge entering the armed service, and the only progress made was in preparation of results for publication.

How Plants Feed—A soil may contain in available form to the plant an abundance of mineral elements, but the kinds and amounts of these elements that will be taken up and accumulated by the plant depend upon certain vital processes in the plant itself.

Exact knowledge of how plants take up and accumulate the inorganic elements of the soil may be the basis of scientific crop management, including fertilizer practice. The nutritional value of crop plants may be influenced by the mineral content of the plant food it utilizes.

Twelve different agricultural crops, representing seven plant families, were included in a study. While practical application of the results obtained thus far are not yet apparent, they are another step toward an understanding of the factors involved in plant growth.

Basic Knowledge of Breeding and Inheritance—Due to the necessity for work more directly associated with the war effort, only such work was done on this subject as was required to hold it in abeyance and avoid the loss of valuable materials developed thus far. Only the most critical materials for future use are being produced.

Plant Growth Regulators and Flowering Substances—The work of previous years in control of flowering and fruit-set by chemicals was continued, with a view to perfecting methods and obtaining further information of practical value. Attempts are in progress to obtain the flowering hormones themselves by studying the reaction of plants to vitamins, or their building stones.

Poisonous Plants—The loss suffered annually by Maryland stockmen from their animals eating poisonous plants is much greater than is generally appreciated. For a number of years, information regarding the poisonous plants in this state has been assembled and a bulletin on that subject is being printed. It should be of great value to stockmen in determining injurious plants in their pastures.

Closely allied with this work has been the building of an herbarium of Maryland plants. The list now contains more than 2,200 species, varieties, and forms of plants known to occur in the state. These specimens help greatly in serving the people who desire to have identification made of weeds, shrubs, and trees.

Potato Diseases—In an unsprayed test plot at Oakland, blight and hopper burn were very severe. Seedling B247 yielded more in this plot than Pioneer Smooth Rural in an adjacent field which was sprayed 10 times. The vines of Seedling B247 showed considerable resistance to late blight and hopper burn and little blight was found in the tubers. If this seedling continues to perform as well, it will be named and distributed in the near future. Thirty-six of the 247 seedlings in this field were resistant to late blight and hopper burn.

Resistance to Fusarium was studied at Oakland and College Park by introducing the organism into the soil on cultures of sterilized oats. Weather conditions were unfavorable for wilt at Oakland, but favorable at College Park. Only the varieties Chippewa and Quick Lunch and one seedling of the 36 grown at College Park showed any evidence of resistance.

Best yields with early varieties at Pocomoke were made by Irish Cobbler and Colorado Seedling 110. Among late varieties at Pocomoke, Sequoia and Seedling B247 yielded more than twice as much as the standard Dakota Red variety. This was evidently due to their drought resistance, as there was practically no rain during the growing season.

Results from spraying potatoes at Pocomoke with yellow copper oxide were almost as good as from spraying with 4-4-50 Bordeaux mixture.

Strawberry Disease—A new method for determining resistance to red stele disease by artificial inoculation in the greenhouse was used with 95 strawberry hybrids which had previously been selected for resistance in the field. This method will be of great value in selection for red stele resistance in the future.

Several new field plots were established for testing red stele resistant hybrids on various soil types.

Raspberry Virus Diseases—Results obtained from plantings two to four years old indicate commercial control of mild streak, severe streak and mosaic can be obtained profitably by roguing, provided the original planting stock is reasonably free from disease. Records of yields and prices show a high return for plantings subjected to rigid virus control practices.

Tobacco Diseases—Tobacco anthracnose (small pox), discovered in Maryland in 1940, became very destructive to seedling plants the past year. In some locations farmers were unable to draw any plants from their infected beds. This disease appeared in the field for the first time, causing white spots on leaves and cankers on the stalks.

Seven chemical spray materials were used to control this disease in the plant bed. Bordeaux mixture appeared to give best control. No perfect stage of the fungus has been found, but it is believed that the disease is carried on the seed and seed treatment is recommended for its control.

DAIRY CATTLE AND DAIRY PRODUCTS

Soybean-Millet-Molasses Silage Compared With Corn Silage—No significant difference in milk production was observed between soybean-millet-molasses silage and corn silage when used in trials with 36 cows. When the milk production was adjusted to an equal basis of 4 per cent fat, the cows averaged 32.03 pounds of milk daily on corn silage and 31.62 pounds on soybean-millet-molasses silage.

There was a noticeable difference in the palatability in favor of corn silage. The cows maintained their live weight better on corn silage, although the difference was small. Flavor scores of milk produced on the two silages were practically equal.

Dry Starters for Dairy Calves—Present demands for milk make it desirable for dairymen to use a minimum of whole milk in raising calves. For approximately four years, all calves in the Experiment Station herd have been raised satisfactorily on a dry calf starter. Its formula was devised by another experiment station and is sold commercially in Maryland.

To compare with this starter, a new formula has been devised using ingredients more readily available. In this mixture, crimped oats replaces rolled oats, dried whey replaces dried skimmilk, and soybean oil meal replaces corn gluten feed and corn oil meal. The cod-liver oil has been removed and alfalfa leaf meal and irradiated yeast have been added.

One lot of calves receives the old formula, a second lot receives the new formula, and a third lot receives the new formula with part of the ingredients in pellet form.

This experiment has not been running long enough to draw conclusions, but indications so far are slightly in favor of the pellet mixture. Calves start eating this mixture a little earlier, consume larger amounts, make a slightly better growth, and have a little more bloom of hair and hide.

Kelp Meal in Dairy Rations—An experiment with 37 pairs of heifers to determine the value of adding kelp meal to the ration has been completed. All heifers received the same hay and silage, but one group received a grain mixture containing 4 per cent of kelp meal, while the other group received the same grain mixture without the kelp meal. No significant difference was apparent in rate of growth, health, or breeding efficiency.

A further phase of this experiment consists of 26 pairs of animals which have been continued through a second gestation. Preliminary results indicate no measurable difference in reproductive efficiency between the cows on the two rations.

Feeding Value of Cheat for Dairy Cows—Cheat is regarded as a weed, as it is commonly grown on farms, yet chemical analyses show that the grain is similar in composition to barley and oats. Field tests have shown that cheat will outyield oats and, under many conditions, will outyield barley.

Because of the possibilities of cheat as a feed crop, a feeding trial has been conducted to compare it with barley. The double reversal system of feeding was employed, using 12 cows. Both groups received the same kind and amounts of hay and silage. One group received a grain mixture containing 600 pounds of ground cheat to the ton; the other mixture was identical except that it contained 600 pounds of ground barley to replace the cheat.

There was no difference in palatability and no measurable difference in milk production. The cows averaged 30.11 pounds of fat-corrected milk daily on the cheat ration, and 29.63 pounds of fat-corrected milk on the barley ration. Live weight was maintained slightly better on the barley ration.

Further experiments are necessary before practical recommendations may be made, but the first trial shows excellent possibilities for this feed.

Vitamin and Carotene Requirements of Calves—Practical observations indicate that calves may suffer from vitamin A deficiency, especially if they are weaned from milk at an early age. Investigations now in progress will help to establish the requirements of calves for vitamin A and carotene, so that recommendations can be made to dairy farmers.

Results show that when a calf is born its blood plasma contains very little vitamin A or carotene. After they take colostrum, high values are obtained, which tend to drop after the calf is removed from the cow. It has been found also that feeding good quality lespedeza hay very markedly increases the vitamin A and carotene content of the blood plasma of dairy calves after about one month of age above that of calves receiving a good grade of alfalfa or clover and timothy hay.

Preliminary results indicate that the vitamin and carotene requirements may be somewhat less during the summer than in winter.

Determining Vitamin A Deficiency—From a practical standpoint, it is desirable to diagnose vitamin A deficiency in the field. In calves, examination of the inner parts of the eye with an ophthalmoscope has proved an effective method of diagnosis. Limited results to date indicate that cows have a higher intraocular tension than calves. In that event, the diagnosis of vitamin A deficiency by ophthalmoscopic examination would be less accurate in cows than for calves.

Effects of Vitamin A Deficiency on the Central Nervous System—When calves are born to cows fed vitamin A deficient rations, they are usually blind, partially paralyzed, and exhibit symptoms of alterations of the central nervous system. It is hoped that investigations on this problem will provide an explanation of the alterations which take place in vitamin A deficiency. Results obtained may possibly be of value in human nutrition.

Rate of Oxidation of Fat From Natural and Remade Cream—It was thought that the rate of oxidation of fat might possibly provide a method for differentiating between natural and remade cream.

Natural cream was obtained from freshly separated milk. Remade cream was prepared by emulsifying unsalted sweet cream butter with fresh skimmilk and mixed cream from a mixture of natural and remade cream. The fat was extracted from each cream, held at 95 degrees C., and peroxide values determined after various intervals. In most instances, oxidation was induced earlier and proceeded more rapidly in mixed and remade cream than in natural cream. In these instances, differentiation required 24 to 96 hours.

Riboflavin (Vitamin B_2) Content of Natural and Remade Cream—Manufacture of remade cream by emulsifying an excellent quality of unsalted sweet cream butter in skimmilk and mixing the product with fresh cream is entirely possible. The manufacture of such a product would be a violation of health department regulations, would increase local milk surpluses, and, if low in riboflavin, would be of lower nutritional value. An effort is being made to develop methods for differentiating between natural and remade cream on the basis of riboflavin content, but sufficient research has not yet been completed.

Factors Affecting Acidity of Ice Cream Mixes—Factors heretofore considered unimportant have been shown to have an important bearing on the pH and acidity of ice cream mixes. When mixes of the same composition are made from different sources of products, the mixes may vary considerably in titrable acidity and pH. The results obtained emphasize the importance of age and temperature when making a pH determination on ice cream mix. They show also that temperature compensators on pH meters cannot always be relied upon for converting a pH reading from one temperature to another.

THE BATTLE AGAINST INSECTS

Corn Earworm—Because of the warm fall of 1941 and mild winter following, there was a heavy carry-over of earworm, which resulted in the heaviest infestation in several years. Moth baits were used in large-scale field experiments to reduce infestation in sweet corn and various promising insecticides, including cryolite and arsenicals, were tested on string beans as protection against the worm.

European Corn Borer—Injury to corn on the Eastern Shore by the European corn borer has been considerably less during the past two years than in 1940. Continued observations are being made at time of planting and on varietal resistance to injury.

Pea Aphid—Results of several years' work indicate that nicotine sulphate sprayed under the apron is highly effective against pea aphid and from year to year is more consistent than the rotenone-bearing sprays. Four per cent nicotine dust, applied under a 50-foot apron, has not given a satisfactory kill of these plant lice. A longer apron increases the effectiveness of the dusts.

Tobacco Insects—The population of tobacco hornworm has been so low the past season that no chemical control experiments have been possible. The trapping program with isoamyl salicylate as a lure was operative throughout the season, but catches per trap were very low.

Concentrated Sprays—Development of machinery for effectively applying concentrated water sprays promises reduced spraying costs and more efficient use of insecticides. Preliminary experiments at Ridgley show that one pint of derris extract in 10 gallons of water per acre, when finely atomized, is as effective as the one quart in 100 gallons used in ordinary spraying.

Insect Hibernation—Knowledge of where and how insects spend the winter is of value, both in devising methods for their control and for indications as to the possible infestation the following growing season.

The extent of corn earworm injury is dependent upon the severity of winter temperatures. The carry-over is high following mild winters and when there are several mild winters in succession there is a season to season build-up. On the other hand, the severity of pea aphid injury is not affected by the mildness of the winter, but rather by warm early spring weather, which favors its early spring development on its over-wintering host plants, the most important of which is alfalfa.

FRUIT AND VEGETABLE CROPS

Edible Soybeans—An Old Crop in a New Role—As early as 1938, canners and growers began making inquiries about the possibilities of edible soybeans as a canning crop in Maryland. They wanted to know how they would yield as compared with such crops as lima beans, what varieties are best adapted to this section, and what canning procedure would be necessary to give the best quality canned product.

Out of an extensive list of varieties, nine were selected for trial in 1940. Another variety was added in 1941. Higan, with 2,668 pounds of shelled beans per acre, was the highest yielding variety in 1940. Bansei outyielded all others with 5,474 pounds of shelled beans per acre in 1941. These yields indicate satisfactory production.

After the beans had been canned for several months, canned samples of each variety were examined critically by a group of judges including food technologists, licensed Federal graders, canners, and others working in the industry. They were scored for color, character of liquor, flavor, and maturity.

The variety Emperor scored highest in canning quality in each of the two years, but was followed closely by Giant Green, Toku, Jogun, Higan, Hokkaido, and Willomi. Its quality score was so nearly approached by some of the other varieties that, when yield is considered along with quality, other varieties might be more desirable for commercial production.

Variety Trials of Sweet Peas for Canning—Results of variety trials for a number of years on the Eastern Shore show that good yields of high-quality sweet peas can be obtained, but the varieties which are suited to the climatic and soil conditions mature only a few days later than Alaska and cannot be used to lengthen appreciably the canning season. If planted late to reach the canning stage after Alaska, they are apt to run into hot weather before harvest and the yields be disappointing.

Out of 60 or more strains or varieties tested for a period of years on the Eastern Shore, the following have yielded about equal to Alaska: Dark Podded Thomas Laxton, Laxton's Cropper, and Pride. Glacier, a variety developed for freezing, has consistently produced favorable yields. Mardelah is the earliest of the sweet varieties tested and has given fair yields, but has not averaged as high as the varieties mentioned. Canner King is a high-quality pea that has yielded well in cool seasons, but it is a little too late in the average year for the warmer sections of the state. Due to hot, dry weather late in the season, the late-maturing varieties are usually a total loss.

Starter Solutions for Tomatoes—The value of several of the newer starter solutions for tomatoes was demonstrated clearly in the dry planting season of 1940. At College Park the increased stand, or survival of plants, was 30 per cent and 69 per cent, respectively, for two solutions. The latter is a new type developed by the Maryland Experiment Station.

A starter solution is a mixture of chemicals which is added to water, and the solution is applied to the soil around the roots of the tomato plant at planting time. These solutions not only improved the stand of plants, but also increased early growth, improved the color of the foliage, and the treated plots could be distinguished at the end of six weeks. Such results cannot be expected under ideal planting conditions, but the low cost of such treatment, where water is applied either by hand or by machine, justified their use.

Controlling Cantaloupe Defoliation—Loss in efficiency of the leaves of cantaloupes is not due entirely to disease. Many of the lesions found on the leaves which were believed to be forms of downy mildew or Macrosporium have been found to be the result of improper balance of soil nutrients.

Losses due to plant diseases can be controlled by spraying or dusting, if the lower as well as the upper surfaces of leaves are covered. This has been shown by three years' work. Spraying is very satisfactory only if adequate pressure is supplied at the nozzle and if the nozzles are pointed at an angle that gives complete coverage.

Nutrition studies indicate that the most neglected fertilizers in the culture of cantaloupes are lime, magnesia, and potash. Lack of sufficient available calcium is responsible for many of the small necrotic spots found on leaves, and for the yellowing and death of the margins of leaves. Deficiency of magnesium causes the appearance of small, yellow blisters scattered over the surface of the older leaves. It would be easy to confuse calcium deficiency with Macrosporium blight; magnesium deficiency with the later stages of Macrosporium; and the early stages of potassium deficiency with early symptoms of downy mildew.

The appearance of symptoms of a deficiency does not necessarily mean that more of the deficient fertilizer must be added to the soil, but may be caused by a depressing effect of an over-

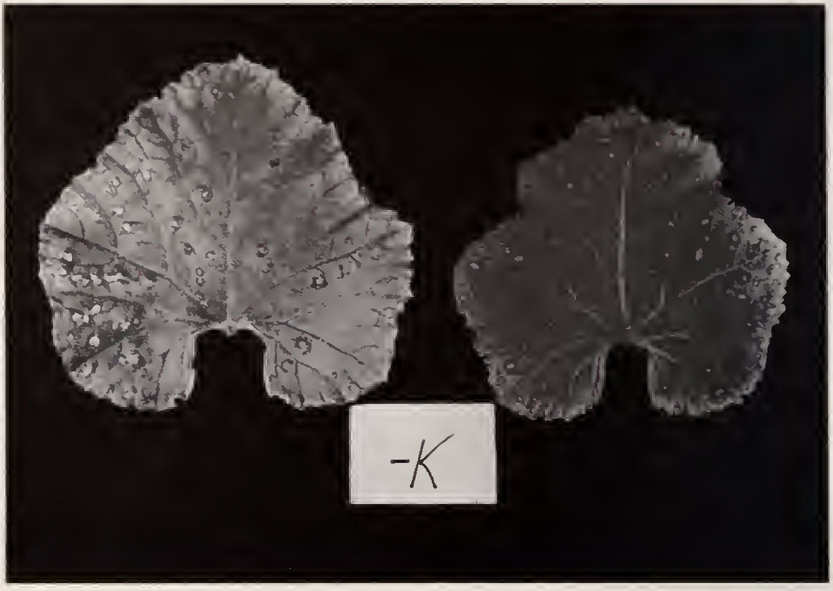

FIG. 1. *Potash deficiency symptoms on cantaloupe leaves. This may be confused with downy mildew.*

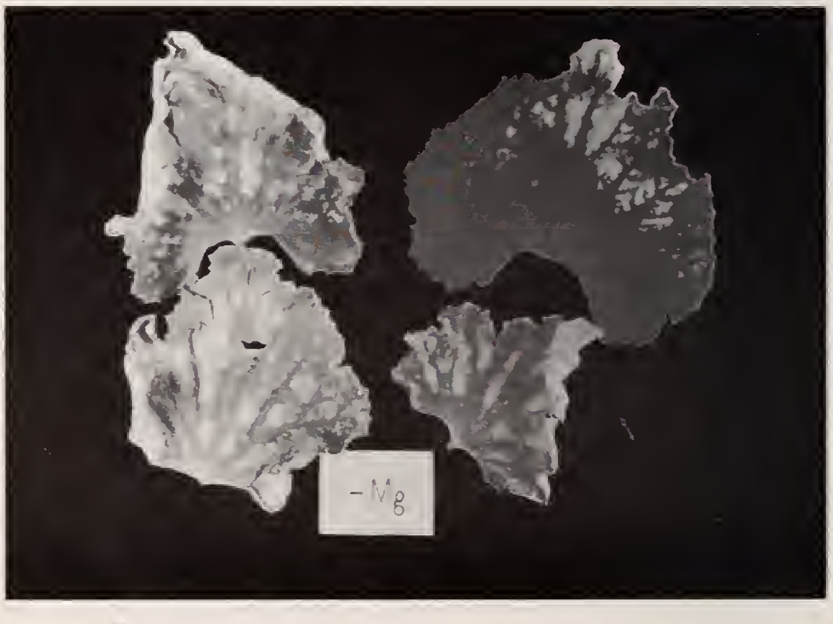

FIG. 2. *Magnesium deficiency on leaves of cantaloupe. In sections where this element is deficient in the soil, magnesium lime should be applied.*

supply of another element. At present, the diagnosis of soil needs can be made from plant symptoms only in conjunction with rapid plant and soil tests.

Fertilizing Cover Crops in Canning Crop Production—In an effort to determine the most economical and rapid method for restoring the organic matter of the soil to its former level, an attempt is being made to raise one canning crop and two cover crops in one year. The cover crops are being grown with and without fertilizer, and with and without nitrogen to break them down or rot them in the soil.

In 1941, the yield of lima beans, as the cash crop in the rotation, was 25 per cent greater on plots which had received cyanamid to grow the non-legume cover crop, with an additional application to rot it, than where no cyanamid had been used. In other words, the investment in cyanamid to grow and rot the cover crop paid a 100 per cent dividend as measured by the income from the lima beans. Comparable yields of lima beans were obtained from plots where soybeans were used in the rota-

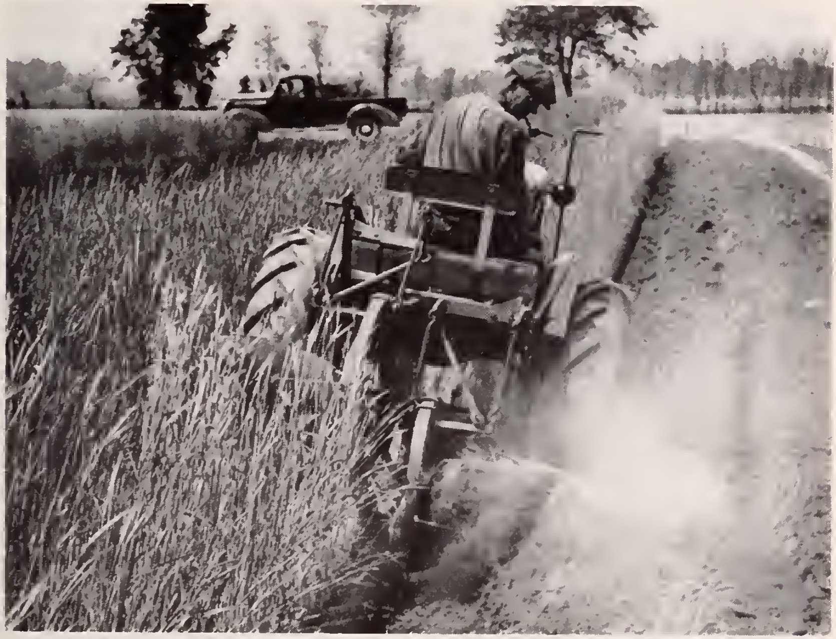

FIG. 3. *Plowing under 8 tons (green weight) of a fertilizer winter cover crop of rye in the canning crop rotation at the Ridgely substation. Organic matter turned under pays big dividends on canning crops which follow.*

tion in place of the initial application of nitrogen to grow the rye, but where notrogen was used to break down the rye when it was turned under.

These results and those of the previous year demonstrate clearly the value and necessity for maintaining a satisfactory level of organic matter in the soil, and that high cash returns may be expected from such a practice. It is necessary to fertilize the cover crop, either by use of commercial fertilizers or by use of leguminous cover crops.

Lima Bean Variety Trials—Tests to determine the best varieties of lima beans and the best times and rates of seeding on the Eastern Shore are being continued.

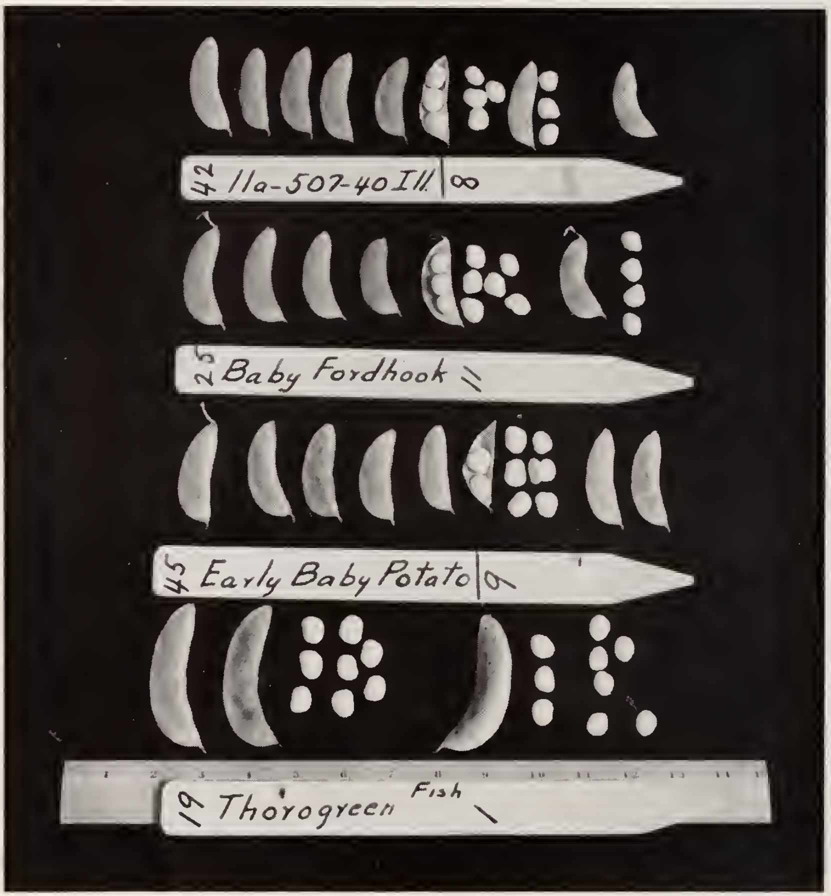

FIG. 4. *Four new types of "Baby limas" grown in the lima bean variety trials at Ridgely.*

Nine of the new "Baby Limas", two strains of Henderson Bush, and one green-seeded Henderson were planted at four different dates. Three of these varieties were planted at four rates of seeding.

Early Baby Potato and two numbered selections of "Baby" varieties from the Illinois Experiment Station yielded as well as Henderson and were judged to be of better quality when canned.

Dates of planting ranged from May 23 to July 3. The third planting, on June 20, gave the highest average yields. Probably due to weather conditions which effected set of pods, the second and fourth plantings, made June 9 and July 3, respectively, gave the lowest yields. The two Henderson strains gave relatively higher yields for the July planting than the "Baby Lima" varieties, which was true the previous year.

There were no significant differences in yields for the different rates of seeding. Previous work indicated that yields of Henderson did not vary appreciably with rather large differences in amount of seed planted per acre, but that some of the new types were affected by rate of seeding.

The green-seeded Henderson showed only about 20 per cent as many white beans as the regular Henderson when harvested at the same stage of maturity. The yield, however, was significantly lower than for regular Henderson.

Peach Varieties Are Being Studied—Several years of growth and fruiting behavior on most of the recent peach introductions are now being observed on the Research Farm. Observations have been made also where these varieties have been included in commercial orchards, in order to evaluate their performance under varying soil and climatic conditions.

Among the varieties heretofore not reported, the following cannot be generally recommended for commercial planting under Maryland conditions: Barbara, Best May, Colora, Fair's Beauty, Fisher, Kalhaven, Leona, Lizzie, O'Boy, Raritan Rose, Redelberta, Triojem, and White Hale.

Three new varieties—Sunhigh, New Day and Pacemaker—show commercial promise, but have not been under test long enough to warrant final statements. New additions made to the test planting in the last two years include: Early Halehaven, Early Rochester, Halo, New Discovery, Red Hale, Red Haven, and Wahlbert.

Peach Malady Receiving Attention—It is hoped that another year of study will reveal the factors which are responsible for the abnormal growth and fruiting behavior of peaches in certain sections of Maryland. Studies were begun during the past year on the nutritional, soil, insect, and virus disease aspects of the problem.

New Maryland Peach Variety To Be Released—It is now planned to name and release to the industry within the coming year one of the Maryland Experiment Station seedlings which has continued to show unusual promise. It is known as No. 1-15.

This seedling has been under cooperative tests with growers at six points in the state for a period of five years. Previously it had produced seven crops in the Station orchard. The fruit is a yellow freestone of Hale type, very firm, of excellent size and quality, high in color, and matures approximately five days before Elberta. It hangs tightly to the tree and remains firm, and has been picked with Elberta by some growers having it under test. Tree growth has been consistently vigorous under heavy cropping.

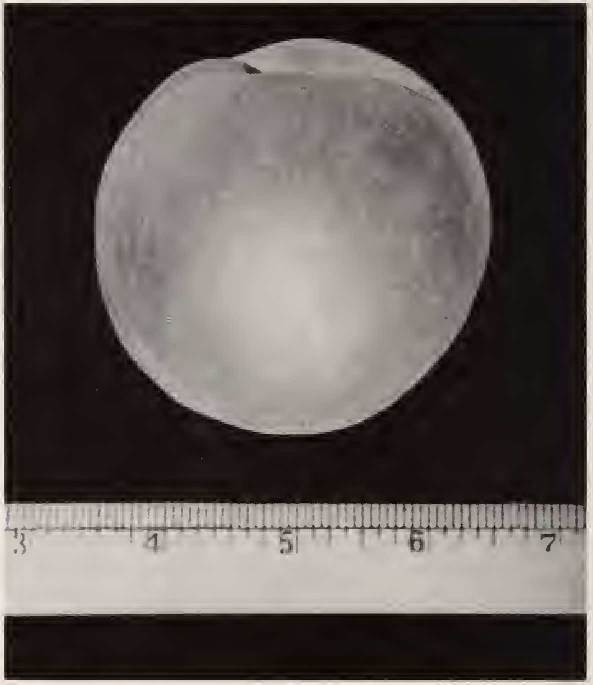

FIG. 5. *New Promising Maryland Peach of about the Elberta season. Md., 1-15, not yet named.*

Waxing Apples Prolongs Storage Life and Quality—Application of a thin water-miscible wax to apples during the packing operation can now be considered feasible for the grower as a low cost method of prolonging the storage and market life of the fruit, and, in addition, reducing loss from shriveling to a minimum under commercial storage and market handling.

Studies which have been in progress over several seasons with Grimes and Golden Delicious were completed during the past year, and results will be available to all growers in Maryland Experiment Station Technical Bulletin A-14.

Factors Influencing Yield and Growth of Delicious Apples—Pollination continues to play an important part in determining the yield of Delicious apples. Three years' work has shown that Rome Beauty and Jonathan are definitely superior as pollenizers for Delicious, compared with other commercial varieties such as York Imperial and Golden Delicious. Gallia Beauty also showed well in two of the three years.

Starting with trees in good state of growth and fruiting, the omission of nitrogen fertilizer has resulted in a gradual slowing of growth, so that the trees at the end of three seasons now show definite signs of nitrogen need, such as light green foliage and poor terminal growth. However, yields during the first two seasons held up about equal to the yields from trees supplied with nitrogen. Analyses of leaves showed a marked decrease in nitrogen content on the no-nitrogen trees, compared with trees supplied with nitrate of soda, or nitrate of soda plus dried blood. Analyses of leaves also indicated a greater intake of potassium in trees supplied with dried blood in addition to nitrate of soda.

No appreciable difference in amount or time of fruit drop, as measured during the entire harvest period, resulted from use of nitrate of soda, or nitrate of soda plus dried blood, even when such materials were supplied to the soil at monthly intervals during the growing season.

New Orchard Soil Covers of Promise—Conservation of soil fertility and prevention of erosion in the orchard are vital in the maintenance of satisfactory growth and producing power of trees that occupy the same land for a long period of years. New types of legumes and grasses can be of service to that end.

Of the several grasses under trial in both the peach and apple orchard, creeping fescue *(Festuca rubra)*, weeping love grass *(Eragrostus curvula)*, and Brage orchard grass *(Dactylis glomerata)* have shown considerable promise under rather low soil fertility conditions.

Future work with legumes and grasses will be important in the development of a system of orchard soil management, requiring the use of more or less permanent orchard covers and the growing of mulch materials outside of the orchard area.

Newer Grape Varieties Are Recommended—Three of the many newer grape varieties being tested have been consistently outstanding—Fredonia, Sheridan, and Seneca.

Fredonia is a black variety that ripens fully two weeks before Concord. Sheridan is also a black variety and ripens just after Concord. Both of these varieties have proved to be vigorous and hardy, of high quality, and possess the fruit characteristics which are desirable for commercial planting. Seneca is an early white grape, ripening a few days before Fredonia, and having unusual quality. In flavor and fruit qualities it closely resembles the European types and it should prove particularly desirable for home use and roadside sale.

Increasing Yield and Improving Size of the Blakemore Strawberry—Use of a narrow row, such as 10 inches rather than the wider row of 30 to 40 inches, definitely increases yield per acre of Blakemore strawberries, when a season does not favor early plant development and good fall development of runner plants in the thinned row system. In a very favorable season for runner

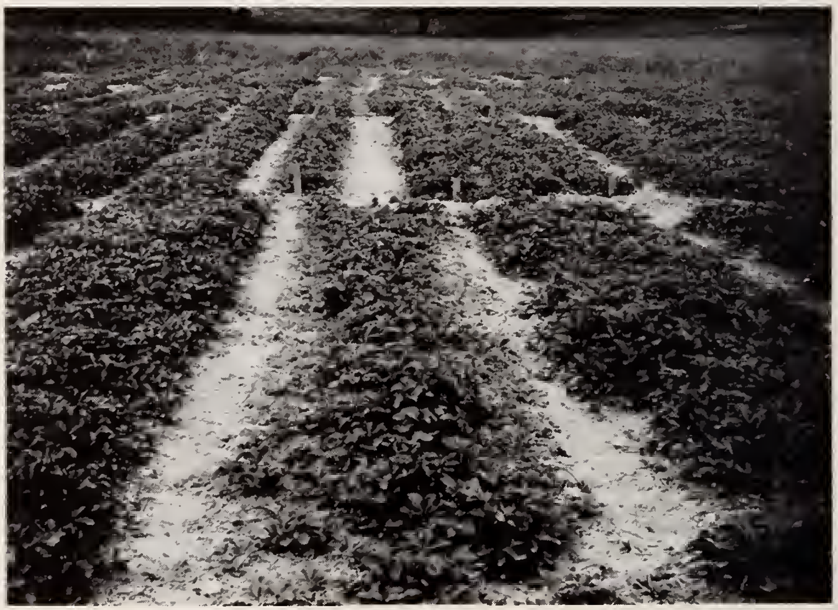

FIG. 6. *Blakemore Strawberry, 30-inch rows with three systems of renewal as the beds appear in September. Left, reversion to a matted row; center, conventional renewal; right, two-year plant renewal system that results in second year yields nearly equal to first year yields.*

plant development, such yield increases may be small, or none at all. Hence, the narrow width of row acts as insurance against unfavorable weather conditions.

In the renewal of strawberry beds for second-year fruiting, the grower usually suffers a decrease in yield of 50 per cent or more, compared with the first season of fruiting of Blakemore. A new system of renewal is possible with the thinned row system of culture, which will give yields in the second season nearly equal to the yield of the first season. This method requires only the removal of all runners during the season following the first year of fruiting, so that the thinned plants of the first season are held over for a second year of fruiting. The cost of runner removal is probably not more than the cost of barring off and cultivating the rows as practiced under the usual method of renewal. Another method of renewing thinned rows is to allow the thinned beds to fill in with runner plants after the first fruiting, so that a matted row results which will yield equal to the usual method of renewal. With both of these newer methods of renewal of thinned rows, the narrow row has an advantage in yield over wider rows.

Mineral Deficiency Symptoms of Black Raspberries—Certain nutrient deficiency symptoms of the Cumberland black raspberry have been determined, with a view to diagnosing growth disorders that have been occurring in commercial plantings in Western Maryland.

The effect upon plant growth of a lack of each of the following single elements was studied: nitrogen, phosphorus, potassium, boron, magnesium, calcium, manganese, and iron. Lack of combinations of certain of the elements was studied also.

With the exception of boron, none of the deficiency symptoms for single elements, or for the combinations of two elements, showed sufficient similarity to the symptoms of the growth disorders to be of aid in clarifying these troubles. Boron deficiency symtoms, however, so closely resemble the type of growth which results from certain mosaic infections, particularly the rosetting of green mosaic, as to make differentiation difficult and careful field studies designed to clarify this aspect must be considered.

POULTRY

Soybean Oil Meal in Poultry Rations—A prospective 100 percent increase in soybean oil meal supply in 1942, coupled with shortages of meat meal and fish meal, called for increasing levels of soybean oil meal in poultry feeds.

Nine lots of broilers were grown satisfactorily on the following mash: ground yellow corn, 28.5 per cent; ground oats, 10 per

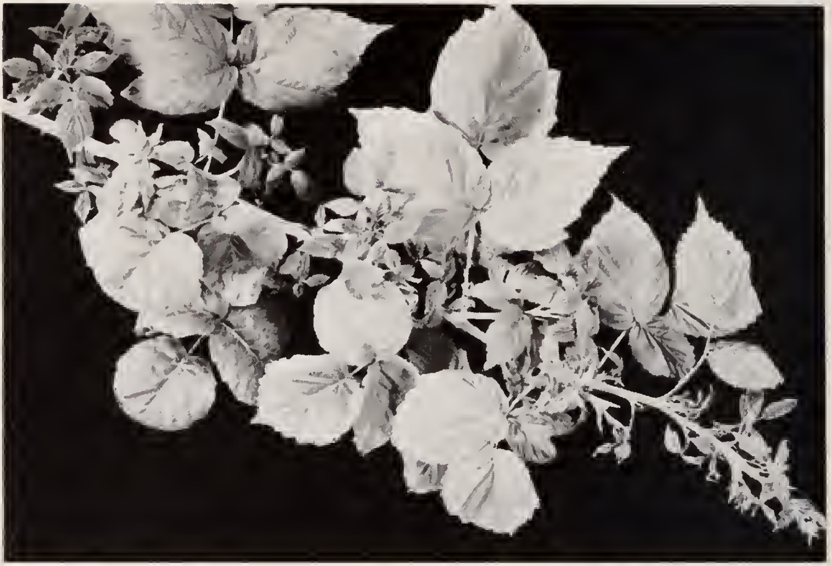

FIG. 7. *Boron deficiency symptoms on young cane of Cumberland black raspberry. Note rosetted type of growth characteristic of certain types of mosaic infection.*

cent; wheat bran, 10 per cent; flour middlings, 10 per cent; alfalfa leaf meal, 5 per cent; soybean oil meal, 24.5 per cent; menhaden meal, 4 per cent; butyl fermentation residue, (Curbay B-G, 40 micrograms riboflavin per gm.), 3 per cent; steamed bone meal, 2 per cent; oystershell flour, 1.5 per cent; vitamin A and D feeding oil, 1 per cent; salt, 0.5 per cent; manganous sulphate tetrahydrate, 0.012 per cent. The 4 per cent of menhaden meal can be replaced by 4 per cent of dried skimmilk, but cannot be replaced satisfactorily by meat and bone meal. Specially prepared samples of meat scrap, containing visceral material as well as muscle and bone, replaced the menhaden meal more satisfactorily than did the commercial meat and bone meal. As much as one-half of the soybean oil meal can be replaced by corn gluten meal.

Shank Pigmentation in Broilers—Excellent shank pigmentation was induced in 6, 8, and 10 weeks old Barred Rock X New Hampshire crossbred chickens in a period of ten days by feeding the following mash: ground yellow corn, 51 per cent; ground oats, 10 per cent; flour middlings, 10 per cent; alfalfa leaf meal, 5 per cent; corn gluten meal, 16 per cent; dried skimmilk, 5 per cent; sodium chloride, 0.5 per cent; steamed bone meal, 1.0 per cent; and oystershell flour, 1.5 per cent. A ten-day period was sufficient to change the shanks from cream color to a deep yellow or orange-yellow. In mashes designed to produce rapid pigmentation, dried skimmilk was a more satisfactory source of animal protein than was meat and bone meal, because of the pigment depressing effect of the latter.

Gizzard Lesions in Chicks—Gizzard erosions and hemorrhages, which occur in at least 75 per cent of all chicks, were not influenced by hatching temperature, or by rate of egg production. Oats, bran, and alfalfa leaf meal have been reported to prevent or cure these lesions when fed to chicks. Previous work at this station indicated that when these feedstuffs were omitted from the hens' diet, the incidence of gizzard lesions in the chicks was increased. However, the incidence was not reduced when high levels of oats and alfalfa leaf meal were fed to hens. Results were obtained indicating that chicks produced by hens kept in batteries have more severe gizzard lesions than chicks from hens kept in open-front houses and fed the same feed.

Vitamin A Requirement of Breeding Stock—Limited supplies of vitamin A sources make necessary more accurate knowledge of vitamin A requirements. The general assumption that more vitamin A is required to produce eggs of high hatchability than to produce market eggs was not supported by experimental results. When hens were fed vitamin A-free diets, no decrease in hatchability occurred up to the time that egg production ceased because of vitamin A deficiency. Groups of hens on different levels of vitamin A intake showed differences in egg production, but no difference in hatchability.

Vitamin D Losses in Stored Mixed Feeds—Mashes were assayed for vitamin D potency by the chick method when freshly mixed and after three months' storage. A loss of 20 to 50 per cent of the original vitamin D potency was indicated during the period. Five sources of vitamin D were used, including 3 oils and 2 "dry" sources. There were no outstanding differences among them, although one of the oils seemed to show greater destruction than the others.

Vitamin D Requirements in Relation to Calcium and Phosphorus Intake—This work was undertaken at a time when it appeared that there might be a scarcity of vitamin D sources. Although the scarcity did not materialize, the finding that broilers can be produced without either direct sunlight or dietary vitamin D is of theoretical interest and potential practical value.

This result was achieved by feeding a mash containing 3.5 to 4.5 per cent of calcium, with a calcium-phosphorus ratio of 2:1. Since the chicks did not grow at the maximum rate and showed a rather high incidence of crooked breast bones, vitamin D-free mashes of this type would be useful only in case of a serious shortage of vitamin D sources. The vitamin D requirement of chicks, judged by growth, feed efficiency, and bone ash, was reduced at least 50 per cent by increasing the calcium content of the mash from 1.7 to 3.6 per cent and the phosphorus content sufficiently to maintain a 2:1 calcium-phosphorus ratio.

Relation of Diet and Management to Hatchability—Much concern has been expressed over the possibility of decreased hatchability resulting from changes in feed formulas necessitated by present feed shortages. Experiments at the station indicate that an all-mash ration of grains, mill by-products, good quality alfalfa leaf meal, menhaden meal, soybean oil meal, vitamin A and D feeding oil, and mineral supplements can be made satisfactory for production of hatching eggs by the addition of just one vitamin—riboflavin. When low-riboflavin mashes were fed, an interesting difference in response between battery hens and hens kept in open-front houses was discovered. Hatchability of eggs from the former decreased to less than 20 per cent within a month and remained at a very low figure, while hatchability of eggs from the latter varied between 40 and 80 per cent during a period of 16 months. In an attempt to explain this difference, the feces of riboflavin deficient hens were fed to other deficient hens in batteries, and hatchability promptly increased to about 80 per cent. It has been shown previously that bacterial synthesis of riboflavin occurs in chicken feces and it would appear that such synthesis may contribute to the riboflavin supply of chickens which have access to their feces.

Efficiency of Feed Utilization in Market Egg Production—Individual feed consumption, body weight, and egg production data were obtained for 102 birds representing hens and pullets of laying age and of different breeds and crossbreds ranging in weight from 1½ to 7¼ pounds. The birds were kept in laying cages in a basement room with continuous lighting and were fed the regular Maryland Experiment Station mash.

It was found that efficiency in the utilization of feed decreases with increasing body weight. The values obtained for maximum gross feed efficiency indicate that among birds laying 365 eggs in a year a 3-pound bird would consume 3.24 pounds of feed per dozen eggs produced, whereas a 7-pound bird would consume 4.38 pounds of feed per dozen eggs produced. Maximum gross feed efficiency varies from 46.3 to 34.3 per cent, maximum gross energetic efficiency from 24.7 to 18.3 per cent, and maximum digestible protein efficiency from 47.8 to 35.2 per cent for 3-pound to 7-pound birds, respectively, in each case.

Inheritance of Rate of Growth and Feathering—Observations were made on purebred Barred Plymouth Rocks and Brown Leghorn stock and on crossbred progeny between these breeds. Body shape, determined by the ratio of mean shank length to the cube root of mean body weight of the progenies of the parental, first-hybrid generation, and backgross matings, was found to vary only slightly at 8 weeks of age.

Neither the sex-linked gene B for barring, nor the sex-linked gene K for slow rate of feathering, had a significant influence on rate of growth. In all matings but one, the non-barred fast-feathering males and females grew at a more rapid rate than the barred fast-feathering, barred slow-feathering, and non-barred slow-feathering males and females.

Use of Fluorescent Lights For Layers—No advantage of fluorescent lighting of Rhode Island Red pullets compared with regular lighting was shown in a preliminary test conducted by the Poultry Department in cooperation with the Agricultural Engineering Department. Fluorescent lighting costs more to install and when operated in a cold room may not give length of life commensurate with this increased initial cost.

Breast Blisters in Battery Broilers—"Breast blisters," an abcess-like swelling filled with a serous fluid which is clear in most instances but is bloody occasionally, sometimes develops on broilers reared in batteries. The blister detracts from the market appearance of the broiler and contributes to a substantial cut in market value and price.

It has been found that proper construction of the floor of the battery will produce birds 95 per cent of which are free from blisters, and the balance are not blistered sufficiently to cause a market cut. The experiment is being continued in an attempt to eliminate breast blisters entirely.

Breeding For Resistance to Pullorum Disease—During 1942, pullorum resistant Station Rhode Island Reds were bred for improved economic qualities and dams were progeny tested for resistance by artificial inoculation of progenies. The latter test revealed that resistance of the stock is increasing, since 65.1 per cent of the dams produced chicks all of which survived the following artificial inoculation with the live organism at the standard level of inoculation employed. In 1941, less than 38 per cent of the dams gave similar results. Evidence to date indicates that while resistance is increasing, it is not of the solid type. An attempt is being made to find birds which are solidly resistant to the disease, instead of the partial resistance encountered to date.

In cooperation with the Livestock Sanitary Service, efforts are being made to develop a biological method of protection of baby chicks which are free from pullorum disease when they are to be transferred to an environment likely to be heavily infested.

PUBLICATIONS

BULLETINS

Number	Title	Authors
A1 (Tech.)	Feed and Other Costs of Producing Market Eggs	T. C. Byerly
A2 (Tech.)	Characteristics of Farm Property Assessments in Maryland after the Last Reassessment	Earl E. Miller William P. Walker
A3	An Economic Study of the Distillery Industry in Maryland	S. H. DeVault W. P. Walker R. W. Harrison
A4	The Potato Enterprise in Garrett County, Maryland	A. B. Hamilton S. H. DeVault
A5	Farmers Mutual Fire Insurance in Maryland	P. R. Poffenberger S. H. DeVault G. H. Goldsborough
A6	Value of a Fermentation By-Product in Poultry Feeds	A. C. Groschke H. R. Bird
A7	The Pistol Casebearer in Maryland	H. S. McConnell
A8	Short Term Credit on the Lower Eastern Shore of Maryland	P. R. Poffenberger S. H. DeVault A. J. Lodman
A9	Extent of Changes and Equalization Produced in Farm Property Assessments by Reassessing in Maryland	Wm. P. Walker Earl E. Miller
A10	Poisonous Plants of Maryland in Relation to Livestock	George B. Reynard J. B. S. Norton
A11	Where Frederick and Salisbury, Md., Get Their Food Supplies	Wm. Paul Walker R. F. Burdette
A12	Relation of Vitamin A to Egg Production and Hatchability	Max Rubin H. R. Bird
A13	Soybean-Millet Molasses Silage for Dairy Cows	M. H. Berry K. L. Turk
Pop. 1	Greater Production of Tomatoes for Canning	C. H. Mahoney H. A. Hunter

SCIENTIFIC JOURNAL ARTICLES

Art. No.

A1 The Effect of Mosaic Virus on Cellular Respiration. M. W. Woods and H. G. DuBuy.

A2 Freezable Water Content and the Oxygen Respiration in Wheat and Rye Grown at Different Stages of Ripening. H. G. Shirk. Amer. Jour. Botany.

A3 Effect of Certain Protein Supplements in Inhibiting Pigment Deposition in Growing Chicks. T. G. Culton and H. R. Bird. Poultry Science Vol. XX (5), Sept., 1941.

A4 Scion Influence on Nursery Apple Tree Roots. F. B. Lincoln. Amer. Soc. Hort. Sci. Vol. 39, 1941.

A5 Chromosome Number and Hybridization in Gladiolus. R. Bamford. Jour. of Heredity, Vol. 32 (12), 1941.

A6 Anthracnose Disease in Maryland Tobacco Plant Beds. E. A. Walker and S. E. Wise. Plant Disease Reporter, 1941.

A7 Studies on Oat Flour as an Antioxidant for Milk Exposed to Sunlight. C. W. England and Arthur P. Wiedemer. The Milk Dealer, Vol. 31, p. 33, Dec., 1941.

A8 Synthesis of Tobacco Mosaic Virus Protein in Relation to Leaf Chromoprotein and Cell Metabolism. M. W. Woods and H. G. DuBuy. Jour. Phytopathology.

A9 Gizzard Lesions in Day Old Chicks. I. Their Relationship to Subsequent Growth and Mortality and Their Prevalence. A. E. Tepper and H. R. Bird. Poultry Sci. Vol. Jan., 1942.

A10 A Study of the Relation of Unfreezable Water to Cold Hardiness of Insects. L. P. Ditman, G. B. Vogt and Dwight R. Smith.

A11 Effects of Nutrition on Variability in the Growth of Chickens. John C. Hammond and H. R. Bird.

A12 Gizzard Lesions in Day Old Chicks. II. The Time of Origin and Factors Influencing the Cause of Gizzard Lesions in Chicks. A. E. Tepper and H. R. Bird. Poultry Science, Vol. 21, January, 1942.

A13 Gizzard Lesions in Day Old Chicks. III. Can Severity of Incidence be Reduced by Dietary Control? A. E. Tepper and H. R. Bird. Poultry Science, Vol. 21, January, 1942.

A14 Grade and Price Comparisons of Del-Mar-Va and Virginia Broilers and Fryers. R. E. Mai and J. M. Gwin. Poultry Sci., Vol. 21, January, 1942.

A15 Embryological Studies. 1. Maturation, Fertilization, and Early Cleavage in the Hen's Egg. M. W. Olsen. Jour. of Morphology.

A16 Size of Thymus and Bursa Fabricius in Relation to Rate of Growth in Chicks. John C. Hammond and H. R. Bird. Poultry Science.

A17 Feather Pigment Changes Associated with Tumorous Conditions in Brown Leghorn Makes. Mary Juhn.

A18 A Study of the Germicidal Power of Sodium Chloroorthophenylphenate Compared with Calcium Hypochlorite in the Presence of Tomato Juice. L. H. James and William Nolte. Food Industries.

A19 A Study of the Germicidal Power of Some Orthophenylphenol Compounds Compared with Standard Chlorine Disinfectants in the Presence of Oyster Liquor. William A. Nolte and L. H. James. Food Research, Vol. 6 (6), 1941.

A20 Differences in Sugar Content of Grass Associated with Soil Fertility, Growth Conditions and Growth Habit. A. O. Kuhn and W. B. Kemp. Jour. Amer. Soc. of Agron.

A21 The Vitamin A and Carotene Content of the Blood Plasma of Calves from birth to Four Months of Age Under Various Conditions. L. A. Moore. American Dairy Science Assn.

A22 Activation of Dicalcium Phosphate for the Chromatogeoplin Determination of Carotene. L. A. Moore. Jour. of Ind. and Engr. Chemistry.

A23 Yield and Quality Tests of Edible Soybeans Grown for Canning in Maryland. Amer. Soc. Hort. Sci. E. P. Walls.

A24 Histological Development of Fiber in the Pods of the Snapbean. F. C. Stark and C. H. Mahoney. Amer. Soc. Hort. Soc.

A25 The Influence of Various Renewal Systems and Width of Row on Yields of the Blakemore Strawberry. J. C. Crane and I. C. Haut. Amer. Soc. Hort. Sci.

A26 Comparison of Certain Varieties as Pollenizers for the Delicious Apple. W. H. Griggs and A. L. Schrader. Amer. Soc. Hort. Sci.

A27 The Role of Ether Soluble Organic Acids in the Cation-anion Balance in Plants. Elwood C. Pierce.

A28 Some Effects of Sand and Nutrient Supply on a Physiological Leaf Spot of Cantaloupes. Elwood C. Pierce and D. L. Stoddard. Journal of Amer. Soc. of Plant Pathologists.

MISCELLANEOUS PERIODICALS, REPORTS, PROCEEDINGS, ETC.

Art. No.

1 Soilless Culture of Plants (Hydroponics). R. Bamford. Mimeo. Circ.

2 Comparative Census of Maryland Agriculture by Counties. A. B. Hamilton. Mimeo. Circ.

3 The Performance of Hybrid Corn in 1941. R. G. Rothgeb and A. D. Hoadley. Plano. Circ.

4 Sweet Corn Field Trials in 1941. R. G. Rothgeb. Mimeo. Circ.

5 Owed to a Co-op by a Member. News for Farmer Cooperatives, Sept., 1941. R. B. Corbett. Oklahoma Cotton Grower, Oct., 1941.

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7 Farm Real Estate and Mortgage Indebtedness. P. R. Poffenberger. Mimeo. Circ.

8 Some of the Results of the Pea Aphid Control Investigations in Maryland. L. P. Ditman, C. Graham, and E. N. Cory. Mimeo. Circ. (The Canners School, 1941.)

9 Growing Snapbeans for Canning. Market Growers' Journal, April, 1942. C. H. Mahoney.

CURRENT PROJECTS

AGRICULTURAL ECONOMICS

Organization, Operation and Business Analysis of Maryland Farms. (Purnell A-18)

Balancing the Crop, Livestock and Equipment Investment. (Purnell A-18-m)

Cost and Advisability of Raising Dairy Heifers. (Purnell A-18-n)

Labor Requirements for Selected Crops in Maryland. (Purnell A-18-q)

Housing Conditions and Facilities for Farm Labor in Maryland. (Purnell A-18-s)

Farm Labor Requirements. (Purnell A-18-t)

Farm Management Adjustments and Factors Encountered by Farmers in Attaining Increased Production in the Wartime Program. (Purnell A-18-u)

The Farm Tax Problem in Maryland. (Purnell A-19)

Economic or Social Facts which Justify the Improving or Surfacing of Rural County Roads in Maryland. (Purnell A-19-c)

Marketing of Agricultural Commodities. (Purnell A-26)

The Relationship of Quality to Retail Prices of Canned Vegetables. (Purnell A-26-g)

Marketing Maryland Broilers. (Purnell A-26-h)

Maryland Farm Price Relationships. (Purnell A-26-i)

The Effect of Changes in Transportation on Marketing Systems for Maryland Farm Products. (Purnell A-26-j)

The Problem of Priorities and Rationing in Relation to Agricultural Production and Marketing in Maryland. (Purnell A-26-k)

Prices Paid by Farmers for Commodities Bought. (Purnell A-26-l)

Problems in Marketing Arising from the War Emergency. (Purnell A-26-m)

Maryland Farm Statistics. (State)

AGRICULTURAL ENGINEERING

The Development of a Small Electric Milk Pasteurizer. (Bankhead-Jones R-3)

Investigations of Grain Storage on the Farm. (Bankhead-Jones R-6)

A Study of Egg Coolers and Cooling Conditions. (Bankhead-Jones R-7)

Artificial Lighting of Dairy Stables. (Bankhead-Jones R-8)

AGRONOMY

Wheat—Hybridization and Selection. (Hatch B-39)

Barley—Hybridization for Smooth Awns. (Hatch B-41)

Hay, Forage and Pasture. (Hatch B-42)

Soybean Production in Maryland. (State B-43)

Sweet Corn—Seed Production and Breeding. (Purnell B-44)

Improvement of Pastures in the Several Soil Provinces of Maryland. (Bankhead-Jones B-49)

Development of Dent Corn Hybrids Specifically Adapted to the Corn-Growing Areas of Maryland. (Bankhead-Jones B-50)

Effects of Different Short Rotations on Physical, Chemical and Pathological Conditions in the Soil and on Crop Production. (Purnell B-52)

Curing of Maryland Tobacco. (State B-53)

Field Studies of the Fertility Requirements and Management of Important Soil Types in Maryland. (Hatch O-27)

Fertilizer Studies with Early Potatoes and Sweet Potatoes on Norfolk Sand. (State O-28)

A Study of the Formula and Analysis for Late Potatoes. (State O-28-b)

Efficiency of Soil Fertility Management. (Purnell O-33)

Hydrologic Studies with Reference to Soil Moisture Conservation, Soil Fertility, and Flood Control. (Bankhead-Jones O-43)

A Biochemical-Biological Study of Means to Increase the Organic Colloidal Complex of the Soil. (Adams O-44)

A Study of the Chemical and Physical Changes Produced in a Soil by the Formation of the Organic Colloidal Complex. (Adams O-44-a)

Soil Fertility Investigations on the University Farms. (State O-45)

Soil Fertility Studies at the University Farms. Influence of Various Fertilizer Ratios. (State O-45-a)

A Study of the Availability of Phosphate Material. (State O-45-b)

A Study of Methods of Estimating the Available Potassium in Maryland Soils by the Rapid Soil Testing. (State O-46)

The Available Supplies and Relative Agricultural Value of By-product Liming Materials of Eastern Maryland. (State O-47)

Production of Grain Sorghums. (State)

Tobacco Investigations. (State—Cooperative with U. S. D. A.)

The Improvement, Production, and Use of Rye in Maryland. (State)

A Study of the Methods of Obtaining Total Exchange Capacity and Exchangeable Bases in Soils. (State)

A Study of the Factors Affecting the Boron Availability of Maryland Soils. (State)

Inspection of Seeds Sold Throughout the State. (State N-7)

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Study of the Quality of Maryland Hams. (Purnell C-6)

The Relative Net Energy Values of Barley in Comparison to Corn, and of Corn Silage in Comparison to Alfalfa Hay when Fed in Fattening Rations to Steer Calves. (State C-7)

Swine Breeding Investigations in the State of Maryland. (State C-8)

Wintering Rations for Pregnant Ewes. (Purnell C-9)

ANIMAL PATHOLOGY

Blackhead (Infectious Enterohepatitis) in Turkeys. (Purnell D-28)

Running Fits (Canine Hysteria, Fright Disease) in Dogs. (State D-37)

Bovine Pyelonephritis—Diagnosis, Treatment, Control and Eradication. (State D-39)

Periodic or Recurrent Ophthalmia of Horses and Mules—Field Studies. (State D-41)

Diagnosis of Pregnancy in Mares. (State D-42)

Streptococcic Septicemia of Horses and Mules. (State D-43)

Bovine Trichomoniasis—Diagnosis, Treatment, Control, and Eradication. (State D-44)

Trichinosis—Diagnostic Methods. (State D-45)

Bang's Disease—Calfhood Vaccination. (State D-46)

BACTERIOLOGY

Quality of Frozen Vegetables as Influenced by Methods of Handling of Raw Stock, Processing, Storage, and Utilization. (Purnell Q-58-d)

The Influence of Methods of Handling on the Microbial Flora of Poultry and Poultry Products and the Influence of the Microorganisms on Composition and Quality. (State R-1)

The Influence of the Microflora of the Intestines of Chickens upon Quality of Poultry with Special Reference to Freezing and Cold Storage. (State R-1-a)

The Influence of Different Micro-organisms upon the Quality of Frozen Egg Products. (State R-1-b)

BOTANY, PLANT PATHOLOGY AND PLANT PHYSIOLOGY

Physiological and Biochemical Aspects of Vegetable Storage. (Adams K-7)

The Relation Between Vernalization and the Activities of Plant Growth Regulators, Flowering Substances, etc. (Adams K-22)

Relationship of Organic Acids to Salt Absorption and Accumulation by Plants. (Adams K-25)

Cytogenetic Studies in the Genera Ipomoea, Gladiolus, and Tulipa. (Bankhead-Jones F-9)

The Effect of Inducing Polyploidy on the Drug and Oil Content of Some Plants. (Adams F-10)

The Occurrence and Use of Haploid Plants Resulting from Twin Seedling of Pepper, Cantaloupe, and other Vegetable Plants of Importance to Maryland Growers. (Bankhead-Jones F-11)

Potato Seed Improvement and Disease Control. (State J-72)

Strawberry Root Diseases. (Purnell J-78)

Breeding Strawberries for Resistance to the Red Stele Disease Caused by Phytophthora fragariae Hickman. (Purnell J-78-a)

Disease Resistance in Potatoes. (Bankhead-Jones J-80)

Disease Resistance in Potatoes with Special Reference to Wilt and Late Blight. (Bankhead-Jones J-80-a)

Processes Involved in Multiplication of Viruses in Living Suscept Cells. (Adams J-82)

DAIRY HUSBANDRY

Growth Data of Dairy Animals from Birth to Freshening Age. (State G-11)

The Effect of Feeding Kelp Meal upon Improving the Breeding Efficiency of Dairy Cattle. (Hatch G-17)

The Riboflavin (Vitamin G) Content of Cream and of Remade Cream. (State G-24)

The Feeding Value of Cheat for Dairy Cows. (Bankhead-Jones G-26)

The Vitamin "A" and Carotene Requirements for Dairy Calves. (Bankhead-Jones G-27)

Normal Age Variations of the Intra-ocular Tension of Dairy Cattle. (Bankhead-Jones G-28)

The Effects of Vitamin A Deficiency on the Central Nervous System of Dairy Calves. (State G-29)

Reproductive Efficiency in Dairy Cattle. (State G-30)

Dry Starters for Dairy Calves. (Bankhead-Jones G-31)

The Effect of Conditions of Storage upon the Conservation of the Vitamin Content of Whole Milk Powder. (State G-32)

ENTOMOLOGY

Investigations of the Biology and Control of Insects Affecting Canning Crops—The Corn Ear Worm. (Purnell H-29-2)

Investigations of the Biology and Control of Insects Affecting Canning Crops—The Pea Aphis. (Purnell H-29-3)

Nursery Insects. (State H-35)

Biology and Control of Tobacco Insects—The Tobacco Hornworm. (Bankhead-Jones H-40-1)

Biology and Control of the Japanese Beetle. (State H-41)

Ecological and Physiological Factors Concerned with the Hibernation of Insects. (Adams H-42)

The Biology and Control of the European Corn Borer under Maryland Conditions. (Adams H-43)

Disease Resistance of Selected Strains of Honeybees. (State H-44)

Practicability of Migratory Beekeeping in Maryland. (State H-45)

Concentrated Sprays. (Adams H-46)

HORTICULTURE

Vegetative Propagation with Special Reference to Cuttings. (Purnell E-1)

The Effect of Rootstocks on the Production and Quality of Apples. (Purnell E-2)

A Study of Factors Influencing Color in Apples. (Purnell L-67)

Red Color Development on Red Strains (Bud Sports) of Commercial Apple Varieties. (Purnell L-67-a)

Factors Affecting Maturity, Shipping and Storage Quality of Fruits. (Purnell L-68)

Relation of Soil Moisture, Age of Plants, etc., to Flower Differentiation and Quality of the Strawberry. (Bankhead-Jones L-72)

Adaptation of Fruit Varieties and New Seedlings to Maryland. (State L-73)

The Growth and Fruiting Behavior of New Fruit Varieties, Strains, and Seedlings. (State L-73-a)

Environmental Factors and Cultural Practices in Relation to the Growth and Fruiting Responses of Fruits. (State L-74)

The Maintenance of Annual Bearing of Apple Varieties. (State L-74-a)

The Relationship of Early Bearing to Subsequent Growth and Fruiting Behavior of Apple Varieties. (State L-74-b)

Factors Associated with the Productiveness and Unproductiveness of the Delicious Apple. (State L-74-c)

The Pruning of Raspberries in Relation to Growth and Fruiting Behavior. (State L-74-d)

A Diagnosis of Certain Abnormalities in Growth and Fruiting of Peaches in Maryland. (State L-76)

Factors Influencing Yield and Quality in the Production and Processing of Vegetables. (Purnell Q-58)

The Influence of Fertilizer Placements and Analyses on the Yield and Quality of Vegetables Grown for Processing. (Purnell Q-58-a)

Dehydration of Horticultural Crops. (Purnell Q-58-e)

The Value of Organic Matter in the Production of Vegetable Crops. (Purnell Q-67)

A Study of Regional Adaptation of Certain Vegetable Crops and Varieties in Maryland. (State Q-74)

The Effect of Certain Factors on the Growth of Tomato Plants and the Quality of the Fruit. (Purnell Q-75)

Breeding and Genetics of Vegetable Crops. (Hatch Q-76)

Breeding New Strains of Vegetable Crops. (Hatch Q-76-a)

Breeding Disease Resistant Strains of Vegetable Crops. (Hatch Q-76-b)

Breeding and Selection of a Fruitful Type of Lima Bean for Maryland. (Purnell Q-76-c)

Crop Management Studies with Vegetable Crops. (State Q-77)

Physiological Effects of Sprays and Dusts on Cantaloupes, Especially in Relation to Defoliation, Vine Growth, Fruit Setting, and Fruit Quality. (Bankhead-Jones Q-78)

POULTRY

Physiology of Reproduction of Poultry. (Adams M-32)

The Physiology of Ovulation in the Domestic Fowl. (Adams M-32-a)

Factors Affecting Quality of Poultry Products. (Purnell M-33)

Factors Affecting Qualities of Eggs. (Purnell M-33-a)

The Efficiency of Poultry in the Utilization of Feed. (Purnell M-34)

Nutritive Requirements of Poultry. (Purnell M-35)

The Place of Soybean Meal in Poultry Rations. (Purnell M-35-a)

Effect of Various Protein Supplements on Pigmentation in Broilers. (Purnell M-35-e)

Viability of Maryland Poultry. (Bankhead-Jones M-36)

Viability of Barred Chickens. (Bankhead-Jones M-36-a)

Resistance to Pullorum Disease in Chickens. (Bankhead-Jones M-36-b)

Physiology and Genetics of Feather Growth. (State)

The Reaction Potentialities of the Feather Germ to Hormones, Carcinogenic Agents, and Related Compounds. (State)

CHANGES IN PERSONNEL

John Mullady,	Seed Analyst,	April 16, 1942,	Ensign.
H. L. Bodily,	Instr., Bacteriology,	Sept. 1, 1941,	Public Health.
Michael Pelczar,	Instr., Bacteriology,	May 2, 1942,	2nd Lieut., Army.
H. G. Shirk,	Asst. Prof., Plt. Phys.	May 21, 1941,	Reserve Officer.
W. D. McClellan,	Instr., Plt. Path.,	Sept. 9, 1941	U. S. D. A.
Clifton E. Pierce,	Instr., Plt. Path.,	April 17, 1942,	Civ. War Service.
Chester W. Hitz,	Asst. Prof., Hort.,	June 1, 1942,	2nd Lieut., Army.

Appointments

Dr. Robert E. Phillips, Associate Professor, Poultry Department.

FINANCIAL STATEMENT—July 1, 1941 to June 30, 1942

	FEDERAL FUNDS				
	Hatch	Adams	Purnell	Bankhead-Jones	For Agr. Investigations*
Balance June 30, 1941					
Appropriations 1941-42	$15,000.00	$15,000.00	$60,000.00	$30,259.72	
Receipts from sources other than Federal 41-42:					
State appropriations for agricultural investigations					$100,961.99
Industrial Grants					16,999.33
Sales					52,919.81
					170,881.13
Expenditures:					
Personal Services	$12,717.62	$11,956.66	$47,287.08	$22,739.63	$58,472.42
Supplies and Materials	1,275.96	2,233.25	4,876.13	3,494.62	34,094.85
Communication Service	73.69	37.16	227.02	57.70	1,257.41
Travel Expenses	383.05		1,647.36	546.87	3,216.84
Transportation of Things			430.87	10.62	456.31
Printing and Illustrated Publications			1,253.81	511.47	1,248.68
Heat, Light, Water and Power	281.81	22.07	268.58	12.59	2,161.59
Contingent					1,074.82
Retirement					7,991.00
Equipment	229.37	519.40	2,696.34	2,073.05	12,553.18
Land (purchase and rent)			79.00	250.00	264.00
Structures and Non-Structural Improvements				28.99	760.67
Buildings	38.50	231.46	1,233.81	534.18	
Total expenditures	$15,000.00	$15,000.00	$60,000.00	$30,259.72	$123,551.77
Balances June 30, 1942					47,329.36
Totals	$15,000.00	$15,000.00	$60,000.00	$30,259.72	$170,881.13

*Including Bankhead-Jones offset funds.

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DO NOT CIRCULATE

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